PROCEEDINGS

Eighty-Eighth Annual Conference

OF THE

American Railway Bridge & Building Association

1983

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Proceedings of the

Eighty-Eighth Annual Conference

of the

American Railway

Bridge & Building

Association

Held at

HYATT REGENCY

CHICAGO, ILLINOIS

September 12–14, 1983

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TABLE OF CONTENTS

Page

Index to Advertisers 3
Officers for 1983 6
Officers for 1984 7
Session–September 12, 1983 8
September 13, 1983 62
September 14, 1983 112
Membership Report 96
Treasurer's Report 97
Necrology Report 98
Nomination of Officers 95
Joint Installation of Officers 129
Past Officers 133
Constitution 138
By-Laws 141

ADDRESSES AND COMMITTEE REPORTS

Address—
R. D. Krebs, President, Southern Pacific 12
Clear Track Ahead
Morton Marcus, Research Economist, Indiana University 21
Slide Control and Prevention—
Committee Report 29
Restoration of Bridge at Hannibal, MO—
E. Bond, Norfolk & Western Railway 40
Replacement of Through Trusses—
Committee Report 43
In-Place Restoration of Timber Piles—
D. W. Brookings, Kansas City Southern Railroad 50
Environmental Compliance and How It Affects B&B—
Committee Report 56
Address—
P. C. White, Vice President-Marketing, Milwaukee Road 63
Thistle Landslide and Track Relocation—
H. V. Meek, General Roadmaster, Denver & Rio Grande Western 68
The Climbing Excavator—
H. Vaughn, Climbing Hoe Company 77
Underwater Inspection of Railroad Bridges—
Thomas Collins, Collins Engineers, Inc. 83
Cost Effective Electronic Control of Buildings—
M. C. Walbrun, Amtrak 89
Proper Installation of Fiberglass Tanks—
J. Bushmeyer, Owens-Corning 99
Recycling Old Buildings—
Committee Report 100
High Pressure Culvert Cleaner—
N. Woodhead, Harben Pump Company 113
Bridge Inspection Boom Device—
J. Gustafson, Bridge Engineer, Burlington Northern 117
French Railways TGV Film 120
Guardrails on Bridges - Panel Discussion 122

INDEX TO ADVERTISERS

	Page
A&K Railroad Materials, Inc.	143
Alert Manufacturing & Supply Company	145 & 147
American Hoist & Derrick Company	149
Anderson Company, The	151
Berkel & Company, Contractors Inc.	152
Berminghammer Corporation, Ltd.	153
Climbing Hoe of America	155
Conley Frog & Switch Company	157
Duff-Norton Company	159 & 161
DePont de Nemours & Company, Inc., E. I.	163
Electro-Motive Division GMC	173
ENERPAC	165
Evans Products Company	167
Fairmont Railway Motors	169
Fulton Supply Company	171
Huck Manufacturing Company	175
Intrusion-Prepakt Inc.	177
Kershaw Manufacturing Company	179
F. K. Ketler Company	181
Koppers Company (The Dividend Information Center)	183
Lewis Bolt & Nut Company	181
Little Giant Crane & Shovel, Inc.	185
Loram Maintenance of Way Inc.	187
Marmon Transmotive Railway Products	188
Microphor	189
Morrison-Knudsen Company, Inc. Railroad Division	190
Omark Industries, Trak-Lok Division	191
Osmose Railroad Division	190
Park Rubber Company, Inc.	192
Penta Construction Corporation	193
Power Parts (Sign) Company	194
Racine Railroad Products, Inc.	195
Rails Company	196
Spider Staging Sales Company	197
Tamper Division Canron Corporation	198
Teleweld Inc.	193
Torrington Company, The	199
Western-Cullen-Hayes, Inc.	200
Professional Services Directory	201

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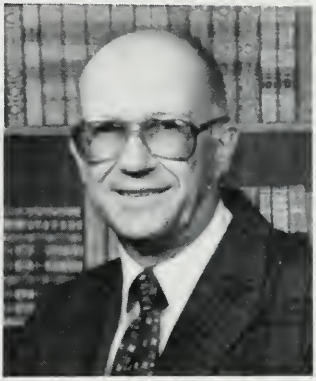

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PROCEEDINGS

OPENING SESSION

Monday, September 12, 1983

The first Joint Session of the Roadmasters and Maintenance of Way Association of America and the American Railway Bridge & Building Association was called to order at the Hyatt Regency Chicago Hotel on Monday, September 12, 1983 at 9:00 A.M., Mr. R. V. Hernandez, President of the Roadmasters and Maintenance of Way Association presiding.

President Hernandez: Good morning. As President of this Centennial Year of the Roadmasters and Maintenance of Way Association of America and on behalf of Mr. O. C. Denz, President of the American Railway Bridge and Building Association, I declare this 95th Annual Technical Conference of the Roadmasters and Maintenance of Way Association of America, and the 88th Annual Conference of the American Railway Bridge and Building Association to be open in joint session.

It is proper that we pause to ask for divine guidance and inspiration prior to commencing our conference. I would like to introduce Father Dennis Hickey of Old St. Mary's Church of Chicago, who will deliver the Invocation. Father Hickey.

Father Hickey: Greetings and welcome to Chicago, on behalf of Cardinal Bernardin and the Church of Chicago. I hope first of all that your stay is a pleasant one and a time of growth and advancement for your organization. And let us now remember that we are in the presence of God.

Almighty and everlasting God, our Father, I pray that you will give everyone here the grace of your presence. Bless this hotel and all who are here with the gift of your love, and grant that everyone will always manifest your love to each other and to all whose lives they touch. May all who are here grow in grace and in the knowledge and love of you. Guide the delegates and the guests, comfort them, strengthen them, and preserve them in peace, O God, now and forever, and bless this hotel that bonds of friendship will be joyfully renewed, deepened, and new ones begun during days of the study, work, play, and growth.

And may the Lord bless you and keep you, may the Lord let his face shine upon you and be gracious to you, and may the Lord show his face to you and give you his peace, and may the road rise to meet you, may the wind be always at your back, may the sun shine warm upon your face and the rain fall soft upon your fields, and until we meet again may God hold you in the palm of his hand.

God bless each and every one of you now and forever. Amen.

President Hernandez: Thank you, Father Hickey, for those words of inspiration. We would be pleased to have you stay for all or any part of the program, but we know you have a busy schedule. Please feel free to leave at any time.

I join with President Denz in welcoming you to the first Joint Session of the two Associations. We sincerely hope you will enjoy your visit to Chicago and urge you to attend the sessions of this two and one half day conference. Please read your program carefully, as it is full of excellent topics. Enjoy yourselves, and partake of the hospitality extended by REMSA.

For the ladies, we have a very interesting program starting today with a visit to the Chicago showing of "The Vatican Collection: The Papacy And Art" at the Chicago Art Institute. This tour includes lunch and will depart this hotel at 10:00 A.M. Registration is in the Water Tower Room. Registration and coffee will again be in the Water Tower Room tomorrow.

I would like to introduce the Officers and Directors of the Roadmasters and Maintenance of Way Association who are seated at the head table. Those whose duties demand their presence elsewhere will be introduced at a later session.

Your Officers are doing an excellent job of directing our Association and they and their counterparts in the American Railway Bridge and Building Association have put together another great conference program. As I introduce each person, I ask that he stand, and remain standing until all have been introduced. Please hold your applause until all have been introduced.

On my extreme right, Mr. E. J. Matte, Director, Manager of Work Equipment, CP Rail, Toronto, Canada.

Mr. J. J. Swiderski, Director, Regional Inspector, Maintenance of Way, CN Rail, Edmonton, Canada.

Mr. C. M. Funk, Director, Engineer of Track, Union Pacific, Omaha, Nebraska.

Mr. J. T. Smith, Director, District Engineer, Union Pacific, San Francisco, California.

Mr. T. R. Rosamond, Director, Assistant Engineer of Track, Seaboard System Railroad, Jacksonville, Florida.

Mr. M. J. Marlow, Director, Supervising Engineer Tracks & Property, Elgin, Joliet & Eastern Railway, Joliet, Illinois.

Mr. D. E. Staplin, Second Vice President, Director of Planning & Reporting, Seaboard System Railroad, Jacksonville, Florida.

Mr. H. V. Meek, First Vice President, General Roadmaster, Denver & Rio Grande Western, Grand Junction, Colorado.

You may now applaud. (Applause)

I will now turn the rostrum over to Mr. Denz, President of the American Railway Bridge and Building Association.

President Denz: Thank you, President Hernandez. It certainly is a pleasure for me to be here and to be able to join with President Hernandez in welcoming all you members and guests to the 1983 Conference here in Chicago which I am sure you will enjoy. Much time and effort has been expended by members of our Associations to develop and provide special features and subjects at the conference sessions that will be informative and interesting to all in attendance. We urge all you fellow members and guests to attend as many sessions as possible and to take away with you all available data and information that could be beneficial to you and/or your railroad.

At this time I would like to introduce the Officers of the American Railway Bridge and Building Association seated here at the head table. As I introduce each one of you, please stand, and remain standing until you are all introduced. Please withhold your applause until all are standing.

Starting at my extreme left, Director R. A. Tallent, Process Engineer Structures, Southern Railway, Atlanta, Georgia.

Director, D. R. Ladner, Assistant Engineer, Chicago & Northwestern Transportation Company, Boone, Iowa.

Director, T. E. Kuhn, Engineer Special Projects, Missouri Pacific, St. Louis, Missouri.

Director, J. W. Davidson, Assistant Director Bridge Engineering, Burlington Northern, Overland Park, Kansas.

Director, J. T. Kapp, Staff Engineer Construction, Conrail, Philadelphia, Pennsylvania.

Director, O. D. Anthony, Assistant Chief Engineer, Bridges & Structures, Bangor & Aroostook, Bangor, Maine.

Treasurer, P. H. Saletnik, Engineer of Buildings, Chicago & Northwestern Transportation Company, Chicago, Illinois.

Junior Vice President, D. A. Bessey, Assistant Chief Engineer of Structures, Milwaukee Road, Chicago, Illinois.

Junior Vice President, J. M. Williams, B & B Supervisor, EJ&E Railway, Gary, Indiana.

Senior Vice President, J. Budzileni, Senior Structural Engineer, ICG, Chicago, Illinois.

You may applaud. (Applause)

Greetings from AREA

At this time it is my pleasure to introduce the Executive Director of the American Railway Engineering Association, Mr. L. T. Cerny.

Mr. Cerny, would you like to say a few words, please?

Mr. Cerny: President Denz, President Hernandez, ladies and gentlemen, the first thing I want to do here is express sincere regrets from AREA President H. L. Rose for not being able to be here this morning and to give you his best wishes for a fine meeting. He is now at home with a bad case of the flu. In fact, when he called me yesterday morning I was embarrassed, because I couldn't even recognize his voice. Apparently his cold is so bad it has altered his voice to that extent.

On behalf of AREA President Rose and the AREA Board I appreciate this opportunity to express the AREA's wholehearted support of the Roadmasters Association and the Bridge and Building Association as dynamic and independent organizations and to congratulate the Roadmasters in their Centennial year.

While there have been some temporary setbacks due to the recession, the outlook for railroading under deregulation is very bright, and I am happy to report that revenue ton miles in the United States in recent weeks have been higher than in any week since the autumn of 1981. The winning of coal contracts that coal slurry pipeline ventures were depending on shows railroads' strong competitive ability. In Canada a few weeks from now we will see the opening of the new British Columbia Railway line across the rugged landscape of the Rocky Mountains to the vast Tumblar Ridge coalfields. Right here in Chicago the new rail Rapid Transit line to O'Hare is partially in service and rapidly nearing completion. The East Coast, earlier this year, saw the inauguration of regular day in, day out 120 mile per hour running speeds, for the first time in the Western Hemisphere, on Amtrak's Northeast Corridor.

It is a great time to be involved in railroading and we certainly can look forward to increased prosperity for both the Roadmasters and B & B Associations.

In Washington, two changes in the track standards are in the news. Last Wednesday some minor changes went into effect in the F.R.A. Track Safety Standards. These were basically editorial in nature to eliminate references to paragraphs deleted in last November's changes. The second change is a proposal to make track which carries commuter trains, but no freight or long distance passenger traffic, subject to the F.R.A. Track Safety Standards. The hearings on this matter will be held in Washington October 4th.

The AREA continues to exercise much vigilance in Washington to preserve freedom and integrity for us who work in the railway track and bridge fields.

Again, best wishes for a successful meeting for both your organizations, and thank you for your time and attention. (Applause)

President Denz: Thank you, Mr. Cerny. I will return the rostrum to President Hernandez.

President Hernandez: Thank you, President Denz, and thank you, Mr. Cerny.

Greetings from REMSA

The Railway Engineering Maintenance Suppliers Association have this year as they have in the past materially assisted our Association, and without their support these conferences may not be possible. It is with pleasure that I present to you J. H. Bush, President of REMSA, and Executive Vice President with the Jackson Jordan Corporation.

Mr. Bush: President Hernandez, President Denz, special guests, ladies and gentlemen, as President of REMSA I am honored to have been asked to join in welcoming you to the 95th Annual Conference of Roadmasters and the 88th Annual Conference of Bridge and Building. I know that all members of REMSA join with me in wishing you a very successful and productive conference.

At the same time it is certainly significant to note the longevity and impact both the Roadmasters and Bridge and Building Associations have had on our industry.

At this time I would like to present to Ray Hernandez on behalf of our membership REMSA's Gold Pin Award which reads, "President, Roadmasters and Maintenance of Way Association of America, 1982-1983." Congratulations, Ray. You have been a great President.

President Hernandez: Thank you.

Mr. Bush: Also, to Omer Denz I would like to present a matching pin which reads, "President of American Railway Bridge and

Building Association, 1982–1983." Omer, congratulations.

President Denz: Thank you very much.

Mr. Bush: REMSA hopes that the stay of all delegates to the conference in Chicago will be pleasant. The Officers and Directors of REMSA are at your call. We mean that sincerely. If there is anything we can do to make your stay more enjoyable please feel free to call on any of us. And to prove that Chicago is not such a bad old town, after a one-day loss, Charley Funk's wallet was returned to him intact.

We know that all of you are looking forward to the Banquet on Tuesday in the Ballroom. You will hear more about that a little bit later. Thank you very much. Ray, back to you. (Applause)

President Hernandez: Thank you very much, Mr. Bush.

Another friend of our Association is Mr. J. Knox Kershaw, First Vice President of REMSA and with Knox Kershaw, Incorporated. Mr. Kershaw.

Members Invited to Banquet

Mr. Kershaw: Presidents Hernandez and Denz, special guests, ladies and gentlemen, it is REMSA's pleasure again to hold its annual Banquet for the Roadmasters and Bridge and Building Associations at their annual Joint Conference. The affair will be held in the Regency Ballroom Tuesday evening. Doors will open at 6:30 P.M. with dinner to be served at 7:00. A musical trio will greet you in the Ballroom, to be followed by dinner and a fast-paced program of entertainment. It is our aim that the festivities be concluded in time to permit all of you to spend some time Tuesday evening with your friends in the suppliers' hospitality suites. Benny Sharp will be with us again. As most of you know, he is an old friend of the railroads and has been a fixture at this annual affair just about as long as all of you can remember. He will be Master of Ceremonies with Joe Conti, a nationally famous comedian as headliner, Cathy Johnson and Bob Monte, song stylist and guitarist, and the Fabulous Darnells, an international novelty act. The Benny Sharp Orchestra will provide the music.

We sincerely hope that those of you who cannot be with us because of the time element or other commitment will forego requesting a ticket as suggested by the Roadmasters and Bridge and Building in their official newsletter. Those of you who will be with us here in Chicago are certainly welcome to be with us. Thank you. (Applause).

President Hernandez: Thank you very much, Mr. Kershaw. We have always enjoyed the Annual Banquet and appreciate the effort put forward by REMSA to sponsor such a fun affair.

We ask that members pick up banquet tickets only if you intend to go to the banquet. If after acquiring your ticket you find that you cannot attend, please return your tickets prior to the dinner.

Introduction of R. D. Krebs

Fellow members, ladies and gentlemen, I consider it an honor, and I am very proud to introduce the Keynote Speaker for our Centennial Conference.

Our guest speaker was born and raised in Sacramento, California. He attended Stanford University and in 1964 achieved a Bachelor of Arts Degree in Political Science. He graduated with distinction and was elected to Phi Beta Kappa. Continuing his education, he attended Harvard Graduate School of Business and in 1966 he successfully completed his Master's Degree in Business Administration.

In 1971 he married his wife Ann. They presently have three children, Robert, Elizabeth, and Duncan. As a community leader he is a member of the Episcopal Diocese of California, Dream of California Commission, the Stanford Alumni Association, and the Board of Directors of St. Luke's Hospital in San Francisco.

He joined Southern Pacific in 1966 where he served on special duty in the Executive Department in San Francisco, California, and subsequently worked as a Transportation Assistant and Special Assistant in San Francisco from 1968 to 1969. In 1969 he was Acting Assistant Trainmaster in the San Joaquin and Oregon Division. From 1969 to 1970 he was Assistant Trainmaster and

Trainmaster for the Oregon Division. From 1970 to 1971 he was the Terminal Superintendent in East St. Louis. From 1971 to 1974 he served as Superintendent of the St. Louis Southwestern Railway Company in Pine Bluff, Arkansas. From 1974 to 1976 he was Assistant General Manager and Assistant Regional Operations Manager in Houston, Texas. From 1976 to 1977 he was Assistant Vice President in San Francisco, California. From 1977 to 1978 he served as Assistant to the President. In 1978 he was appointed General Manager. From 1979 to 1980 he was the Vice President of Transportation. In 1980 he was Acting Vice President of Operations and was elected as a Director for the St. Louis Southwestern Railway Company. From 1980 to 1982 he was Vice President of Operations, and in 1981 he was elected as a Director for the Southern Pacific Transportation Company. On July 1, 1982 he became the President of the Southern Pacific Transportation Company and the St. Louis Southwestern Railway Company.

It is with great pleasure that I present a leading and dynamic railroader, Mr. Robert D. Krebs. (Applause)

Renaissance in the Rail Industry

By Robert D. Krebs

President, Southern Pacific Transportation Company

Robert D. Krebs

Mr. Krebs: Thank you, Ray. I have got to say that is one of the longest short introductions I have ever had.

It is a pleasure to be with you this morning and to help you open your sessions. We are very proud of the work that Ray has done for the Roadmasters Association, and as I said, I am very happy to be here with you.

I want to share with you some of the things that I think are going on in our industry. We have a whole new industry emerging. Deregulation and the recession have caused many changes. These changes are permanent, and this whole industry is never going to be the same. I have got to tell you I think the things that are going on are for the better, and I think without the changes that you are seeing today we just wouldn't survive as an industry. It is about time, in fact it is in the nick of time, that we have some of these changes that are going on.

The three big issues that I see right now facing this industry are deregulation, the restructuring of the industry, or another word for that is the mergers that have been going on, and finally the economy and how it affects us. I am going to talk from kind of a big picture about those three things for a while, and then we are going to get into how they really affect the maintenance of way department and what that does for you and the challenges that it presents in your department.

Deregulation

So let's talk about deregulation first. You know, for a long time, I think we can probably say safely for the last four decades, the railroad industry has been losing its share of intercity freight business to the trucks, and deregulation is coming along just in time to help us recover and to get some of that business back. We are beginning to see that happen on our railroad and throughout the industry.

Deregulation brings one thing with it that is exciting for everybody, and that is competition. We have a lot more competition than we had before, not just competition between railroads but real competition with the trucking industry. I guess that competition was always there but for the first time we actually have a chance to fight back effectively and compete. Now the trucking industry is going through further deregulation themselves, and they are pretty tough competitors. You know they are streamlining their organizations and their operations. They are developing more efficient local networks. They are offering a broader range of distribution services, and their continued excess capacity means we are putting a lot of pressure on the rate structure for intercity freight.

We have got to win more traffic from the highways, and I see signs that we are starting to do that. I think we will look back on this recession and say that this is the first recession when the rail industry didn't lose a large amount of business, a large amount of market share, to the trucking industry. The reason we didn't is because we could be more responsive in this recession. We were better able to go and compete for what was actually a smaller market but hold onto our market share in the recession. I know on SP our piggyback business was up over 20 per cent '82 to '81 and it is up another 15 per cent now. That is business that is directly competitive with the trucks. I just thank goodness that we have the ability to go out and compete and to be responsive to what deregulation has brought.

Now, deregulation has let us do some things with our facilities, too, and this is just in the nick of time. You know, if you look at the railroad industry, we are a business just like any other business. We produce a product just like any other company. We don't make automobiles like General Motors. We don't make appliances like General Electric, and we don't make cereal like General Foods. We produce a product, and our product is rail freight transportation. Now if we are going to stay in business it is going to have to be a good product, a product that is good in terms of quality of service and price, and one that our customers want.

We also need not to produce some products we have been producing in the past that have been losing us money. Deregulation is helping us get out of a couple of those. One of the things we are doing is a kind of rationalizing of our route structure. We are going to see as time goes on that the geographical description of our railroad is going to change. We are getting rid of more branch lines than we have in the past, and we are routing or channeling the traffic over our railroad in such a way that brings us the best profit and lets us provide the best product to our customer.

We have a route simplification program at Southern Pacific that is very important to us. We used to have a great big gathering and distribution area up in Oregon. There is lots of lumber up there. Previously a customer on our railroad using an SP boxcar could originate a carload of lumber up in Oregon, and we would have to pick that car up and perform all the local switching expenses, which are some of the most expensive parts of doing railroad business. That customer could route that car down to someplace in California, say Stockton, and give it to one of our competitors. Our competitor would haul that car over to Texas, where they

would give it back to us. Then we would spot it at a consignee's dock on our railroad. We would incur all the expenses of having to distribute the car, perform the local switching and keep the branch lines going. We lost a lot of revenue, because we got short hauled in the middle.

We have changed our rate structure now because we have a competitive service. We can do it cheaper, and we can provide better service so that a car goes over our system the whole way, and we get the advantage of the revenues.

Now, we made a few people mad in the industry when we did that, but we were very careful to consider everybody's plight when we made our route changes or went through the route simplification program. We knew that we didn't want to be short hauled, and we made sure, when we made the changes, that other railroads didn't have to short haul themselves because of the changes in our route structure.

Now we had some retaliation from some other railroads recently where they closed industries to switching, industries that used to be open to reciprocal switching. We think this is terrible, because this really cuts down on competition. We are going to go back to those railroads now and offer to sign contracts with them to perform local switching for each other in areas where reciprocal switching has traditionally been established. We hope this will open things back to competition, because deregulation is supposed to improve competition at the same time it is supposed to improve the viability of the railroads in the industry. It is very important that we consider both of these things as we go through our deregulation scenario.

Another thing that deregulation is bringing about is pressure on cost, because we have got pressure on prices. I don't think it is any secret in the industry, especially when you figure we have got to compete more and more with trucks all the time, that we have had some cuts in rates over the last couple of years, because we have excess capacity. That is just a normal, natural thing that has happened in other industries that have been deregulated—airlines for one, banking for another. I don't think it has happened in our industry to such an extent, and I am seeing this now that business is coming back a little bit. We ought to take some price increases, and that's good for us, but we have a real pressure on costs, and things are never going to be the same. It used to be that all railroads had basically the same rates. We all got together in rate bureaus and changed those rates, and we took our time. That was kind of an umbrella over the most inefficient producer, and he could stay in business. But that isn't going to happen anymore. I am not saying you are going to have to be the lowest cost producer to stay in business, but you are darn well going to have to be cost efficient and competitive or you just won't be in business. So cost efficiency is very important to us.

At Southern Pacific if I were standing up here in August of 1979 I would tell you we had 42,000 employees working on our railroad. At the end of last year and the beginning of this year we were down to 30,000 employees. We are back up to about 31,000 employees now, but we will never have the employees we had before on our railroad. We couldn't afford them then, and even more we can't afford them now.

So those things that have been brought about by deregulation are very pervasive. They are here to stay, and as I have said, we have a new industry because of it.

Mergers

Now I want to say something about mergers. We have had a whole bunch of mergers recently in the industry. With the consummation of the UP-MP-WP merger we now have four big systems in the West and three in the East. Of course you hear rumors every day about the next merger, and I know the Southern Pacific is named once or twice in those rumors. I have got to tell you I am not here to provide you with any "scoops" today. We have a man who takes care of the mergers in our railroad, and his name is Mr. Biaggini. We are all very confident in what he does, and we are behind him one hundred per cent.

I don't think it is any secret that we have spent a lot of time and money looking at mergers and which mergers do make sense or don't make sense for SP both from an

offensive and defensive standpoint. Mr. Biaggini answered a few questions on it recently himself at one of our own management meetings. He also made some comments at the annual meeting that we had in New York the first part of this year. What he said is that with this, the consummation of the MOP-UP merger, we have an imbalance situation with four big systems in the West and three in the East.

Now we have looked pretty closely at transcontinental mergers. We don't think transcontinental mergers make a lot of sense, and here is why we don't think they make sense. Say we were to merge with one of the big Eastern systems. Well, we get business from all three eastern systems. We would just make the other two mad, and they would merge with a couple of our competitors in the West and we would end up with the same amount of traffic. We would just be splitting it a little bit differently. That doesn't make a lot of sense to us. But with four big systems in the West and three in the East there is this imbalance situation. If we ever were to have transcontinental mergers there would be one poor devil in the West that got left out. So we think if anything makes sense, it makes sense for another merger in the West, and that would cut it down to three and three.

The last time I heard Mr. Biaggini talk about this he also said he didn't have anything on his plate at this time, but he was very willing to talk to anybody who wanted to talk to us. So that is the merger situation.

Of course mergers have changed the structure of the industry, because they have changed the way traffic is being routed. We now are a big railroad in Kansas City. We got there just in the nick of time, because more and more transcontinental business is coming to Kansas City and bypassing St. Louis. Kansas City is becoming a much more important transcontinental gateway.

The Economy

The last issue that I want to talk about briefly is the economy. I had lunch last Friday and listened to probably one of the more respected economists in the nation. He said, "Ladies and gentlemen, I can assure you this is a booming, dynamic, robust economy, and I can guarantee you that it is going to be great for at least six months." (Laughter) And that is kind of the way we see it. We have seen some good starts in some businesses, some of our areas of business. Lumber came back very well since the first of the year, and then all of a sudden we had talk about interest rates going up. Sure enough, the prime went up a little bit, and mortgage rates went up a little bit, and right after the Fourth of July there goes lumber.

The one commodity we see that is still going strong is automobiles. That is coming back very well. We now have one plant left on the West Coast, and it has been producing at double shift for the last two or three months. It had to shut down for a week here recently. It couldn't get enough parts to keep producing. So we hope that the automobile industry will continue to grow. I saw in The Chicago Tribune today where General Motors said that they are going to increase their production in '84 thirty per cent over this year, and of course that is good news to us.

The thing we haven't seen is improvement in the basic industries in the nation that are so important to a long term economic expansion comeback. I am talking about copper, I am talking about iron and steel, I am talking about other construction materials. We have to get those all going. We have to get capital expenditure growth. We have to get people starting to build the infrastructure of our industrial system again before we can really say we have an economic recovery that is here to stay, and we haven't really seen that happen yet.

Of course next year is an election year. We expect that will make things a little brighter for us. On the other hand we have this large federal deficit. Every time we seem to get under way there is not enough money in the economy, and interest rates go up, and we get a little stalled. So we are taking a very cautious look or a cautious view of the economy for next year.

Well, what does all this mean? It means that we have got a market out there that has shrunk in the last couple of years. It means we have got more competition. It means we are not too certain. We have got to be patient on this economic recovery that is kind of starting out. It puts the pressure on us to go

out there and get more business and to feel we have to take it from other sources. It is not going to come from an expansion. What is it going to come from? It is going to come from our being smarter and increasing our market share of the total intercity freight transportation market.

Customer Relations

We have got to get closer to our customers. We have to provide a product for our customers that the customer wants. It is no surprise or no coincidence on the SP that the person who is now running our whole commercial effort, all our marketing and sales, was, about seven months ago, the Senior Vice President of Sales and Distribution for one of the largest customers we have in California. We hired a customer to run our Sales and Marketing Department, because we figured, if we are going to be customer-oriented, the way to do it was to bring some customers in, because they know what the customers want.

It is no surprise or no coincidence that our A.V.P. Sales in New York, just about four months ago, was the Traffic Manager for Celanese Chemical Company. A lot of our New York accounts are chemical companies, so we have a chemical customer now running the sales effort in New York.

Two months ago the fellow who is our A.V.P. Sales at Portland in the Northwest, where all our lumber business is, was the Corporate Traffic Manager for Potlatch Lumber Company. So that is the way we are helping to get ourselves more customer-oriented.

We are also working very hard with deregulation to be more responsive and to get things done more quickly for our customers. We have reorganized our whole sales marketing effort. Our sales people now have more responsibility and authority. We have put AVP's in New York and Atlanta even though our tracks don't go there, because we have a lot of customers there. We wanted some power and some authority back there to make decisions. We can't make all the decisions from San Francisco. When we do we run the business off to trucks or to other railroads because we are not responsive. We are actually letting our sales representatives in some areas go out and sign contracts on the spot with customers to get business, giving them latitude to do the rate negotiations at the local level on the spot. That is something that a year or two ago in the rail industry would have been totally unheard of.

We have reorganized marketing and pricing and put those together in San Francisco. We now have a product group for lumber and a product group for construction materials right on down the line. All the marketing and pricing decisions are made in this group. We don't have a lot of bureaucratic procedures we have to go through in San Francisco anymore. That is helping us to become more responsive. And that is the way that we are going to get business; to react just that way.

Cost Controls

I also said that we are doing a lot to cut costs, and I told you what happened to our work force and of the fact that it is not coming back. There are a lot of areas of improvement that we have made in the operations that have allowed us to compete and bring business to the railroad at the rates that it takes to bring us that business.

Each year over the last three or four years, we have gotten 3 per cent more efficient in the use of our fuel. Our fuel bill back in '79 was running four hundred million dollars a month. So you can multiply 3 percent for just three years and have almost forty million dollars in savings in fuel. That is almost enough to fund the tie program, and that is very important to us.

A few years ago, out of every hundred dollars of revenue we took in on our railroad we gave our customers back $1.25 in freight loss and damage claims from banging up their merchandise. The last two months those claims have come in under 50 cents each month. Our average this year is going to be about 85 cents. That is saving us another seven or eight million dollars that can go into things like funding the maintenance programs on our railroad.

We have also improved the efficiency of our train and engine crews about 4 per cent a year. Unfortunately, the wage increases that we have given, of about 10 per cent a year

each year over the last three or four years, have eaten that up and then some. But the improvement in terms of real efficiency has been very important to us. So we have been doing a lot of things like that to get ourselves in better shape.

Cost controls are here to stay. It is not a new way of life; it is an emphasized way of life. They are not going to go away. It is just that simple.

Now where does this put us all in relation to maintenance of way? We have been going around and talking to all our managers. In fact, I am leaving from here to go down to Houston, where we are meeting with our managers in Houston and Lafayette tomorrow. That will be the last of ten meetings to talk to 1,500 of our managers. We are telling them that our railroad and our industry are in the midst of a transition, and it is a very difficult time because of all the change that is going on, and that is certainly true in the Maintenance of Way Department. At the same time that we have the pressure on to provide a more consistent, a more competitive, a more reliable and a faster transportation service we also have to hang onto some railroad that won't be here in the future. As we are shifting our emphasis onto our main lines to create superhighways, an interstate system out of them more or less, we still have the pressures to maintain the branch lines until we decide what to do with them, until we shrink them down. So we have a major job to do. We have to build up our core route at the same time that we have to continue to maintain for the time being, at least, a big branch line structure, and that's tough.

Quality Maintenance of Way Work

At SP we figure that out of about 14,000 miles of railroad our core route is some 7,600 miles. More and more we are putting our emphasis on that core route. That is why we were able in the last two years, in the midst of the worst recession since the Depression, to cut 1,200 miles of slow orders off that core route. We are going to cut 500 more miles off this year. We are doing it by emphasizing these routes, by putting production gangs in to rehabilitate the railroad. I talked to Harry Berkshire on the plane last night, and he told me he is now up to ten major tie gangs on the system, and I would say eight of those are working on the core route and just two on the other seven thousand miles of railroad. Also, there are four major rail gangs for curves and four major rail gangs for tangent rail.

At the same time, in order to channel all of our efforts and put the bulk of our tie and rail into these production gangs, we have had to put less out on the branch lines. So people have really had to be imaginative to keep the branch lines in shape. Now, as we get on to cycle maintenance on these core routes, what we have got to do is do a good job. We have to do an absolute one hundred per cent quality job, because we aren't going to be back there for a while. We don't have the forces anymore just sitting around in the form of section gangs to go in and punch things up in between production work. Quality is vitally important to us. When we go through now we do a job; we don't leave a tie in there that won't make it for another, say, eight years. We do the road crossings, we do the switches. We have surfacing gangs that come along behind and put in plenty of ballast and really put the railroad in shape. When we leave there we want it to look like the best railroad in the United States. That is what we are doing, and that is exactly what is happening to our core route system. It is evolving into a system that is second to none. We are very proud of it, and we know that it is going to be very important in the future to help us provide the kind of service that we have got to provide.

I asked Harry also how many people he had working in the Maintenance of Way Department and he told me around 6,700. He also told me that if I had asked him that question two years ago he would have said 8,300. That shows you what we have done to the force. At the same time he has a bigger rail program and a bigger tie program than he had a couple of years ago. The improvements that he has made and that his people have made in reducing the unit cost for installation in rail and ties have been very important to us. Those reductions, in turn, have allowed us to put in more rail and ties, and the whole thing is kind of feeding on itself.

Facilities are Important

Facilities are very important to us on this core route. Not only are we improving the maintenance but also we are improving our capacity and our facilities. We are structuring ourselves so that this interstate highway system that we are building goes in the right places and is the most efficient, has the shortest miles, and allows us to be competitive in the long run. The best example I can think of is our purchase of the Rock Island Tucumcari line. We spent about 54 million dollars to purchase that line, and then we spent another 100 million dollars to completely rehabilitate it. In about a year and a half we put in more than a million crossties, over a million and a half tons of ballast, 50 miles of continuous welded rail, we rehabilitated the automatic block signal system, and we completely reconstructed 825 highway and other grade crossings. A railroad that used to be restricted to 10, 20, or 30 miles per hour, with a little bit of 40 mile an hour speeds, is now a 60 and 70 mile an hour railroad. Right now we are out there with a couple of Holland welders welding out the joints so that we can get the whole railroad up to 70 miles per hour, doing the welding right in the track. We figure these two welders are going to get about 60 miles of rail a year for us. So that has been very important to us.

Right now in the midst of this recession, which is the worst recession since the Depression, we just cut over Centralized Traffic Control between Houston and the first crew change point on the way to New Orleans. We are doubling the capacity of our yard at Lafayette, Louisiana right outside of New Orleans, so we can block around Houston and New Orleans. We just cut over a ten million dollar new computer and switching system at Englewood Yard in Houston. We are finishing off the first phase of a new yard outside of San Antonio at Kirby, where we will have main line fueling and some capacity to do some blocking and picking up and setting to increase the train speed across our railroad and become more competitive, especially with the trucking industry. We have put in sidings at bottlenecks on many of our key routes, and we are also increasing the capacity of our piggyback facility. I can think of Portland, Roseville outside of Sacramento, Oakland, and Los Angeles that have had capacity improvements just in the last year and a half. That is very important to us. It has allowed us to provide the type of service we need again to be competitive.

The average train speed on the SP a couple of years ago was about 22 miles an hour, and now it is 27 miles an hour. The average car in a terminal a couple of years ago on the SP stayed in that terminal about 29 hours, and now it is down to about 22 hours. The average car that was supposed to go somewhere on the Southern Pacific a couple of years ago was moving about 100 miles a day, and now it is moving about 130 miles a day. Those are all things that add to our reliability and consistency in plant, the things that have made these possible.

Going back to maintenance again, we just recently started on the single effort that most clearly defines our intent to increase the capacity and reliability of our system. In July of this year we began a 36-month 900 mile continuous welded 136 pound rail rehab program over our core routes. The program calls for 150 miles of CWR for the last six months of this year, 300 in each of the next two years, and then 150 miles that would take us out to about 1986, I think. That 900 miles in 36 months will rehab or relay 12 per cent of our core route, and it is an over two hundred million dollar program. We had to borrow money to fund about half of it. We bought the rail. The rail is already signed for; the letters of intent have been signed. Because we bought this rail in the depth of the recession, we saved 30 million dollars on the purchase price of the material alone. That, plus the fact that we are doing this again with system gangs and getting on the track while business is at the bottom of the economic cycle, is saving us other millions of dollars in the labor cost that it takes to put it in. Our maintenance of way people, for the first time, actually have a 36-month program that they can plan on, and they can set up all their programs based on that, and that is a whole new world for them.

I have got to say that the change from betterment accounting to depreciation

accounting has helped us, because now that we are depreciating our maintenance (we are capitalizing and depreciating it) we don't have to worry about the economic cycle and the profit and loss cycle as much anymore. We can just concentrate on building up our system the way we want to build it up. So that has been very important to us, and I think that shows the commitment we have, that the SP has, to the railroading business, and the feeling we have about the future in our industry.

Well now, so there are a lot of challenges here. We are trying to get a better main line system. We are shrinking the railroad, but we haven't quite got it shrunk. We have got less resources, especially people, to do the things that we have to do. How do we do it all?

Well, one of the keys is people. You know, we had a group of fifteen of the top managers of the railroad together the other day, and Harry Berkshire, our Chief Engineer, A.V.P. of Engineering, was one of the fifteen, and we thought to ourselves O.K., now we have got our management team the way we want it. We have a strategy set for us that we think is going to get us where we want to be. We believe in the future of the railroad industry. We have committed this money to rail and ties, we have adequate locomotives now as business comes back, we have better service than we have ever had in the past. What's missing? And we thought, well, what is really missing is getting all the thirty thousand of us that are left working at the same time and moving in the same direction. If we can ever do that, then we have a force that is really unstoppable. That is what we have to do if we are really going to be successful. What we need is some point of reference; we need some system of values. We need something that is simple that we can communicate to all our people and that will help us get everybody moving in the same direction at the same time. So we have put together three simple values, and I just want to tell you a little bit about them. I want to get into the second and third, because you will see that those relate directly to you.

The first one shouldn't be any surprise to you after all I have said about deregulation and customers. Our first value is dedication to our customers' needs. We will listen to our customers and provide them with quality products in terms of service and cost. I have said a lot about that and why that is so important.

The second one, and this brings me to the point that I want to make, is an understanding that our employees play the most important role in taking care of our customers. We know that it is important that we have active communications and that all people at SP Railroad are involved in our efforts. That is why tomorrow I am going to Houston and to Lafayette, and those will be the last two meetings, to talk to 1,500 of our managers about the strategy we have and why these values are so important. In the last two weeks of this month the fifteen of us and a couple more are going to talk to 30,000 employees. We are going to give every employee on Southern Pacific and the Cotton Belt a chance to come in and meet face to face with a couple of our top managers and to hear what our strategy is firsthand. We want to get some feedback from these people as to why we are messed up in some areas, or what we could be doing better, or what they think about the strategy. That is what I am talking about when I talk about communications and getting everybody working together. That is very important to you in the maintenance of way area because, as I said, you are going to have to get more from the people you have working for you. The way you are going to get more, the only way you are going to get more, is if they want to give you more, and the way that they are going to want to give you more is if they understand what they are doing and why they are doing it, and they agree with you, and they are on our team. That's the thing, we all have to be together on one team.

A third value, I will just state it because, I have been talking a lot about it, is a commitment to provide the assets with ample capacity to handle our business. We realize that strong plant and equipment form the backbone of the quality transportation product required to attract and hold customers, and that is directly related to the maintenance of way area and the jobs that all of you have to do.

Summary

Well, let me just summarize what I have

said. I have said we are hearing that we are in trying times. We are going to look back, and we are going to say the 80's were the worst. The 80's were also the best; we couldn't have done it without the 80's. It was a heck of a period to live through, but it saved the industry. It changed the industry once and for all and made it a really competitive force in the intercity freight transportation market. Thank God we had them. Our mission is to get business off the highways. That is the real competitor and the real enemy, and we are starting to see signs of our ability to do that.

The economic recovery, however, isn't going to turn things around for us overnight. We can't count on that. It is going to be gradual, and we have to be patient. We are going to have some big programs in the maintenance of way area to rebuild our core routes; at the same time, though, we are going to have lean operations, when you consider the overall situation in maintenance of way. It is going to be challenging.

I think we will look back, and we will say that the 80's were a period of renaissance in the rail industry, of rebirth, and that the railroads met the challenge, and that because of it we are a better industry today.

Again Ray, I am pleased to be here with you and to help you open your session. I concur with the exchange of information among railroads, especially in the maintenance of way area, I think it benefits each of you in your railroad and the industry as a whole, and I wish you success for a very productive session. Thank you. (Applause)

President Hernandez: Thank you, Mr. Krebs, for a very informative address and for taking the time to come down and speak before our membership.

May I have your attention, please. At 10:00 A.M. this morning our registration is as follows: Roadmaster members 137, B & B 49, Associate Members 166, Guests 45 for a total of 397.

At this time I would like to call upon our Program Chairman, Mr. Mike Marlow, to introduce the next featured speaker. Mr. Marlow.

Mr. Marlow: Thank you, Mr. Hernandez.

Our next featured speaker for this morning is Mr. Morton J. Marcus. Mr. Marcus directs the extensive research and information services of the Division of Research in the Indiana University School of Business. He and the professional staff of the Division study the economy and population of Indiana. Mr. Marcus is the Editor of the monthly *Indiana Business Review* and teaches in the graduate program of the School of Business. In addition, Mr. Marcus serves on the Board of Directors of the non-profit Indiana Secondary Market for Education Loans, Inc.

A native of New York, educated in the Midwest and in California, Morton J. Marcus has been at Indiana University since 1970. He is married, with two teenage sons, and resides in Bloomington, Indiana.

I know that Mr. Marcus will present us with a very interesting and lively talk. Mr. Marcus. (Applause)

Clear Track Ahead

By Morton J. Marcus

Research Economist, Indiana University

Morton J. Marcus

Mr. Marcus: I must say that this morning is the first time I have had the opportunity to be insulted by the president of a railroad. It is undoubtedly the beginning of a long day.

It is traditional to make hostile remarks about economists. I was really disappointed, Mike, in your introduction there. I thought that in this, the 100th year of the birth of Harry Truman, you would have used the Harry Truman insult of economists. That was the least you could have done there. You know, Harry Truman was reported to have said that he wanted to have a one-armed economist, so he wouldn't have to hear about, "But on the other hand."

And that would have given me an opportunity, Mike, if you had used that, to point out that I am not a one-armed economist. I am better known as a one-fingered economist. Very often it is that finger pointing upward indicating that our economy is doing well. Sometimes it is the index finger raised in admonition, and for the photographers up in front very often it is the middle finger. (Laughter)

I think that will look very good in your magazine!

But economists do get a great deal of disrespect. I would say we are probably of all the professions the Rodney Dangerfields, because we have a tendency to see the world differently from the way other people see it. We look at different things and we come to different conclusions.

This is never more clear to me than when my wife starts to hunt for her contact lenses. She is afflicted by contact lenses and spends a good deal of time blinking and dropping them onto carpets such as this and then trying to find them. As you can imagine, she has some difficulty, and I end up finding them, not because I have better eyesight, but because while she is down on the ground looking for that little piece of plastic I am looking for one hundred and twenty five dollars.

And economists at this time see an economy that has already recovered. That is part of the difference. One of the magazines that is out there in the lobby, I notice, talks about how we are going from recession to recovery. No. We are going from recovery to expansion. The recovery phase, that acceleration in the economy, is over, and what we are going into now is a period which we hope will be sustainable expansion of the economy.

The recovery has been dramatic and has been going on something like ten months already. We are now into a later stage, a stage of sustainable expansion at a lower rate perhaps than we have been seeing.

We have had a period of time during which Gross National Product for one quarter nearly grew by an annual 9 per cent rate, and sales and inventories have been matched up fairly well, and we have had this expansion and this improvement largely because the American consumer has been able to go out and start spending once again.

The American economy is not controlled by the President of the United States. The American economy is not controlled by the Chairman of the Federal Reserve Board. The American economy is not controlled by a few large corporations or by a few large unions. The American economy is controlled by 233 million consumers.

Three-quarters of the recovery in GNP is due to a rise in consumer spending, not due to corporate expansion, not due to the orders of the President or the Chairman of the Federal Reserve, but due to the fact that you and your families, my wife in particular, have been spending. That is the real source.

You (the reporter) have to take all these nasty things down for posterity, I presume. You can excise my wife, no doubt.

It is difficult for us to accept this, however. We in this country have such a strong feeling that there must be someone in charge, that it is most disturbing when we find that there really is no one in charge, there is no one at the controls, that it is an uncontrollable mechanism.

It is horrifying, in fact, for most of us to realize that whatever control rests in this economy is in the hands of the jerk who is sitting next to you. That is the terrifying thought: that that fool, who has such ill-considered purchasing patterns, would wear a tie or a suit or that green sock and that red sock, is the person who controls our economy.

Most of us don't want to believe that. We would rather believe that there really is some force out there, some collection that can get together, that can run this system. It isn't the case. And once the American consumer started spending again the American economy began to pick up. And why weren't American consumers spending? Because American consumers have been riding a roller-coaster which has gotten them into a situation where they did not have the funds. They did not have the balance sheet, if you will, for those of you who have what I would consider a parasitic background; that is, trained in accounting. They were not in a frame of mind to see that there was some kind of stable future.

The reason for that is that we had for nearly a decade ever-increasing rates of inflation. We went through the period of time from 1971 when President Nixon imposed wage and price controls, because the rate of inflation had reached 4 per cent. Oh, how we would rejoice today at 4 per cent inflation. But it had reached 4 per cent, and he put in wage and price controls which turned out to be destabilizing. And then we had periods of shocks to the economy. The most serious shock was sexual. You are probably not aware of that, but the most difficult shock that we had to the American economy was a sexual disfunction off the coast of Peru. The little anchovies, the male and the female anchovies in 1973 just couldn't seem to get it together, and as a result the anchovy catch in 1973 was down. When the anchovy catch is down the price of soybeans tends to rise, because anchovies are a major protein supplement for animal feed. Soybean prices rise, corn prices rise, the price of beef rises, the price of pork rises, and we tend to get that whole spiral of inflation in food costs which characterized 1974–75; on top of which we had the oil embargo from the Arab States.

And then we had irresponsible monetary policy during much of the 1970's which led to fusions of money over and over and over and above what was necessary for economic growth, and the American consumer and the American economy were very seriously hurt—I almost used the word destroyed, but that is not the case—but very seriously hurt, by what happened, because we had a fundamental change in our system of values over that ten year period of time. We became a society that valued junk. We became a society that took funds away from productive capital purposes such as the things that you do and put the money into junk.

What has happened in the period 1970, let us say, to 1983? We have seen the value of baseball cards rise faster than the value of shares of stock in America's largest corporations, and we have seen the growth of

investment policies by ordinary households and by major corporations into what I would consider junk. Again, and it is probably true in your family, you have engaged in very similar practices.

In our family my wife takes that Friday newspaper, goes down the classified lists, circles a variety of things, lets me sleep on Saturday mornings, whispers that she's going out "saleing,"—and we don't own a boat. She is going out garage saleing. She is going out throughout Monroe County, Indiana, and she is buying our neighbors' junk, and brings it home—the umbrellas and the toasters and the hair dryers and the curlers—she specializes in small electrical appliances—brings it home and puts it into the vault, which is our basement, which in certain seasons of the year is also the origin of the Mississippi River, and keeps it there. And I have talked with bankers and they have told me that hers is a very wise investment policy, a wise investment policy because it has three key characteristics.

One is appreciation in value. All of this junk has been growing in value. Things that you and I used to throw out we now sell to each other. There has been a situation where a toaster which is only partially functional now has a value and tends to rise over time. So she has the first characteristic, appreciation in value.

Secondly, there is no risk associated with it. What a wonderful investment, an investment without risk, in that, I am sure, any time in the next twenty-seven years I need an umbrella there is one in the basement. There's no risk. We can get utility and value out of that investment.

And finally, most importantly as with all investments, this investment has great liquidity.

Now, our oldest boy went off to college. We tried to get him to go someplace else, but he wanted to go to Indiana University, because it is a great institution with a wide range of courses and, for his benefit, has an application form that is all in pictures. (Laughter) Now when he went off to school my wife was able to go down into the basement, and she was able to bring up her savings, put them out into the driveway, sell them off, and raise tuition money. If I had gone to the credit union, where I foolishly have had payroll deductions for a full decade, if I had done that I could have withdrawn the savings of a decade, and what could I have bought him? Well, the Complete Encyclopedia of Prophylactics, probably little else, and that might have been useful if he had gone to Purdue, or—I see you have some people here from Penn State's home town today.

The point is that in our society we have come to value junk, and the trading of junk has become an important aspect of our society, and we have not been investing. We have not been investing in the capital facilities which are so necessary, as our Southern Pacific President indicated, in the infrastructure of our society, in the basic industries of our society. We have not been making those investments, because investments elsewhere have been more profitable.

Who would want to put money into track and into right of way and into bridges? Who would want to put money there when it is so much more attractive and easier to just put some funds into the money markets, where you get a rate of return, and you have tremendous liquidity, and you don't have to worry about the fact that it will not pay off for two years or three years as the project is going on. You will have a payoff. Your balance sheet will look good immediately. In fact it is better to sell off old rail and to take the proceeds and to put it into the money market under these conditions of tremendous uncertainty, under these conditions of extraordinarily high interest rates, as we have had during periods of time in the past ten years, than it is to make investments in the future, and that is what we have seen.

We have seen American households and American industries investing in junk, people going out and buying gold when there is no reason for holding gold except that you believe that the American dollar is unstable, people going out and buying silver, or buying umbrellas, when there is no reason for holding great stores of silver or umbrellas except that you believe that the American dollar is losing its value and that there is no reason to invest in a productive future but only in an insecure future, a future in which it is going to rain a great deal.

We are right now at a period of time when we feel that the rate of inflation has been

brought down to an acceptable level, 5 per cent. Mr. Reagan, no doubt, will take credit for that. There is no credit for Mr. Reagan, there is no credit for the Congress in this process. The rate of inflation has been brought down in large part through a massive recession following the monetary policy wisely instituted by the Federal Reserve System in which the American public, both business and consumers, cooperated by drawing back, by decreasing the demand for loanable funds. The expansion which took place more recently is because of the decline in the rate of interest which followed the decline in the money supply. The decline in the money supply was not just Federal Reserve policy but was the policy of individual Americans not borrowing money, so that the banking system couldn't expand the money supply, because when you borrow money you are in effect expanding the money supply, and Americans stopped borrowing. They stopped borrowing because they had reached the limits of credit.

We now are in a good period of time, a good period of time for reassessing our values, for reassessing the future of our country, for recognizing that we have done great damage to ourselves and to a future for ourselves and for our children, because we have not paid attention to the fundamental responsibilities of any society, and that is to make sure that the goods that you have, the capital goods, are in condition to be passed on to the future.

1983 is going to see continued economic growth, continued expansion, a little bit higher rate than we would normally expect from the economy, probably 6 to 7 per cent at an annual rate. Durable goods are expected to rise by about 12 per cent. Housing starts are slowing down. We are going to read about several things slowing down. Slowing down in what sense? Meaning that the rate of increase is declining.

For those of you with an engineering background, we are talking about a negative second derivative. You have to put those things in sometimes and remind them of where their antecedents are. Can you get that, a negative second derivative? Actually this man (the reporter) is playing a little Kimball Organ down here, manufactured in Indiana.

The economy is tending to slow down in the sense that the rate of acceleration is coming down, and this is not necessarily something bad, not necessarily something we want to be concerned about. This is something that we expect at the second stage as we move out of the recession. The recession ended in November. It is over. Now, Dan Rather hasn't announced it officially yet, so a lot of people don't know it, and Roger Mudd was dismissed before he could say anything about it, but our economy is doing well and is likely to continue to do well, not just for six months, but for 18 months or 24 months if we don't screw it up. It can continue to do well because American consumers and American corporations are in reasonably good financial condition, and do not have great borrowing needs, and hence will not be putting great pressure on interest rates.

We do anticipate some slight rise in interest rates, largely based on improvement in the world economy, but that may not come about. The world's economy is in a perilous situation, and interest rates move and fluctuate largely in response these days to movements of international capital markets. What is happening in Lebanon, and what is happening in terms of the dispute between the United States and the Soviet Union, which according to today's early morning reports seem to be heating up in a variety of fashions, may cause only more instability. That would mean the price of gold would rise, and would also mean a flight of money from Europe and from other currencies into the American dollar, again raising the value of the dollar. That means that it will be a good time to take a trip to Europe—with the hopes that you can get back—and that also tends to lower, to some extent, domestic interest rates.

But if the world economy stabilizes, if the political situation stabilizes, then what we can anticipate is that the American dollar will not be quite as attractive and hence there will be a decline in the value of the dollar as people begin to sell. Foreigners begin to sell financial assets here in the United States, and as a result take their dollars out of this country and put them into investments in West Germany, and France, and Italy. We will see interest rates rise a little bit on that

basis. American business, experiencing a sustained period of recovery, will begin to think about investing again, and with stable inflation rates investment will become attractive, and interest rates will have a tendency to have a slight upward movement. But these are slight upward movements.

The problem that we have in American business is that too many people spend the morning reading *The Wall Street Journal.* In fact I would say that anyone who spends any part of the day reading *The Wall Street Journal* and does not read it at home at night is obviously a person who is under-employed. Supervisors should look very closely at those people.

We had news in *The Wall Street Journal* issue after issue after issue of improvements in the American economy. Interest rates actually started to rise in early May, but no one paid much attention to it until somewhere in the middle of July (15th, 16th, or 17th, I am not sure of the exact date), they began to hear in the business news on the radio and television and to read in *The Journal* that interest rates are going to rise and are going to choke off the recovery. It was coming to an end. And on the 21st, and 22nd, and 23rd of July and for several weeks thereafter the stock market began to go down very dramatically. There was no change in the fundamental conditions of the economy of the United States. There was no severe news. There was only increased reporting of the possibility that interest rates were going to rise.

Well, interest rates had been rising, and the stock market had been rising as well. Well, finally investors saw that there was nothing to that, and they came back into the market, and the market reached near record highs again; no fundamental change in the economy.

It isn't necessary to follow the economy of the United States on a day by day basis. It doesn't change that much. It isn't necessary to follow the news on a day by day basis. You could miss reading newspapers for a week, and there would still be problems that Rex Morgan had, and Mary Worth would still have the same kinds of difficulties. The only question of what you might miss would be the collapse of the Chicago White Sox, and even that may not happen this year. But we have a penchant in this country for following every little movement. Every time somebody at Dean Witter breaks wind it becomes financial news, and it is not necessary for us to pay such close attention.

What we are seeing is an improvement in our national economy that will extend into 1984 which on average will actually be better than 1983 because the early parts of 1983 were so weak. Business investment is likely to pick up during the year. Housing starts are likely to stabilize at around 1.7 million units. We are going to see the inflation rate remaining pretty stable. Compensation per man-hour will be rising about 5 per cent during the year, unit labor costs rising only about 3 per cent, meaning about a 2 per cent increase in productivity, and that is an indication of an economy that is doing well, and it will likely continue through '84 and into '85. There is nothing on the horizon to indicate any changes in that. It is a sustainable growth if we can keep the rate of inflation down in that level.

People say, "Well, how can that be with such an enormous federal deficit coming up? Isn't the federal government going to go in there and absorb all those funds? Isn't that really the great evil that we have in our society?"

No. The great evil that we have in our society is not the federal deficit, it is the imbalance between federal spending and federal receipts.

"Oh, I thought that was the same thing."

It is not the same thing in the sense that when you concentrate on the deficit you lose focus on what causes the deficit. The deficit is caused by spending exceeding revenues, and there is one way, one simple way, to get rid of the federal deficit.

Federal spending currently accounts for 25 per cent of Gross National Product. Federal taxes account for 19 per cent of Gross National Product. The easy way to get rid of it—raise taxes.

"Raise taxes? President Hernandez, did that son of a bitch just say raise taxes?"

"Unbelievable."

(Now I didn't call President Hernandez a son of a bitch. I hope you got that right. You don't get equal time. You just get the final record.)

Yes, raise taxes. Be willing to pay for the things that we want. Certainly we don't want to cut spending. No way do I want to cut

spending in this country. Federal government spending is too important to me, because I am just like you, a hog with his snout in the federal bucket. Every single one of us is in that position in one way or another, and we do not wish to see the slop that we have been receiving diminished in any fashion.

Don't tamper with Social Security payments. My mother is on Social Security. My aunt is on Social Security. Every single penny that they receive in Social Security money is something I don't have to give them. That's a good system.

Don't touch Medicare. Medicare is important, very important, so that when my mother leaves the nursing home from time to time and goes to the Bloomington Hospital for R & R Medicare picks up the bill. That's a good program. Don't touch that one.

Don't touch the Student Loan Program. Oh, what a beautiful program the Student Loan Program is, one of America's great subsidy programs for middle class Americans. It's marvelous. Don't touch it.

As soon as my boy went off to school, actually got admitted to the university, which showed me how low our standards at the university had sunk, as soon as that happened I sent him to the Credit Union to get a loan, to get a student loan. It's wonderful. There is absolutely no need for him to pay anything back on it until after he is out of school, which in his case may be as late as Halloween. (Laughter) And then he only pays back at a rate of 9 per cent a year. Wouldn't you love to borrow money at 9 per cent a year? Why, it was wonderful.

We today have a new garbage disposal unit. We were able to fix the kitchen counter at the same time, a wide variety of things that were made possible by the student loan. Don't touch that system. That's a good system.

Certainly we in America have come to understand how to use our political system. We don't want to touch a situation that is absolutely divine in nature. Divine is the only word for it, because Moses must have come down from the mountain with more than Ten Commandments. It is the only thing I can figure out. He must have come down with social and religious Commandments on one side of the Tablet and economic Commandments on the other side of the tablet, prudent and economical Hebrew that he was. But Aaron, who mounted them, was a lousy construction manager and just put it up against the wall, and we lost the Economic Commandments.

One of the Economic Commandments is "Thou shalt not pay taxes on interest on your home mortgage." Many of you have home mortgages, I assume, and you itemize deductions. I can see the smile of a hog over there. Yes, sir. Yes, sir. In this last year 1982, 23.3 billion dollars, twenty three point three billion dollars, is the amount of taxes not collected by the federal government, because you and I deducted the interest on our home mortgages from the federal income taxes.

In addition to that, some at this head table are deadbeats. They don't pay their VISA cards on time, they don't pay their Master Charge on time. Don't adjust your glasses, Mike, trying to get out of it. And consumer credit, which includes automobile loans, washing machine loans and all sorts of installment loans of that nature, resulted in a loss of federal revenue of nearly eleven billion dollars.

You want to cut the deficit? Get your snout out of the bucket. But no, we don't want to do that.

You know, there was a time when Jimmy Carter first came into office, naive and virginal in the ways of Washington, he thought about appointing a committee to consider the possibility of establishing a commission which would examine the feasibility of a phase-out of the mortgage interest deduction. Well, you know what happened. The National Association of Home Builders, the U.S. Savings & Loan League, and the Realtor Associations all came down on the peanut farmer from Georgia and taught him exactly what it means to have your nuts shelled. (Laughter)

You cannot take away from the American people their God-given subsidies, their divine right.

You want to cut the national deficit? You can decrease spending or you can increase taxes, but you and I do not want to see that happen unless we can find a way to take it away from the other bastard. Find out what the other bastard receives in benefits that we do not receive and take those away from

him. That is the chief activity in the United States.

I don't know how many of you have ever taken Latin or those of you who did take Latin can remember and still read the Latin motto on the back of a dollar bill. I had to go to see a scholar at Notre Dame to get this and get him out of the locker room. It says "Cut The Other Bastard." That is the motto on the back of the American dollar bill. That is our basic contention in our society because what we have become is a society so interlinked with our federal tax and expenditure policy that we cannot think of making cuts and making changes. So there is little hope to be had from cutting the federal deficit.

Now the federal deficit fortunately, if the economy expands as I have indicated it will, is not going to be a serious issue in raising interest rates, because business loan demand has been fairly flat, and even if it picks up a little bit the improved condition of the American economy will cut down on the needs that we have for that deficit. So I think, in large part, we are not too far from a fairly stable improved situation.

What does it mean?

It means now for the first time in about twenty years we may be able to focus American attention on our basic realities, and our basic realities are the infrastructure of our society. I have just completed a study in Indiana and colleagues across the country are working on their parts of a study of the infrastructure of the United States which will be presented to the Joint Economic Committee of Congress. We are trying to estimate what we need in this country in terms of spending in the public sector and in the private sector for our highways, for our airports, for our waste water systems, for our water supplies. What is it that we need to have a modern telephone network, not just the AT&T system but one coming down into the small towns of America where there are underfunded telephone systems.

I don't know about your states, but I do know that in the State of Indiana we have 56 or 58 different telephone companies. It shows you how backward we can be in the Hoosier State. Many of those are underfunded, with inadequate equipment. Then we talk about industrial expansion. Is there any reason to believe that you can have industrial expansion in a town that has an inadequate telephone system? No. It is impossible. After they take out the branch line of the railroad and there is no telephone system there you don't have a modern network.

Our country is allowing its electric utilities, it is allowing its gas utilities, it is allowing its water systems, publicly or privately owned, to deteriorate. We are a country of diminished expectations. Now we do a great deal of this in the idea that we are rationalizing our system, but in many cases we are destroying the future capabilities of our nation.

We have just heard today of one great railroad that has diminished its track from 14,000 miles down to 7,000 miles. Wasn't that about the kind of figures that we are moving into? Did I hear it correctly? I didn't hear it correctly. Now you see how difficult it is to get the facts right.

There are other railroads, however, that are diminishing their track.

There is a tendency for us to say that all activity is taking place in a few places in this country. There is a tremendous regional imbalance between the enormous rates of growth and expansion that have occurred in the South and in the Southwest and the kind of contraction that has taken place in the Northeast and in the Midwest. What we have seen is abandonment of railroads, and we have seen in a sense abandonment of things as simple as water systems. Now, nobody has actually abandoned the water system; it is just that in terms of its operating performance we have allowed it to deteriorate.

It is my understanding that in large parts of the Midwest we have a situation where only 50 per cent of the water that is pumped is actually metered, the leakage is so great, and we have seen in cities like Columbus, Ohio and Fort Wayne, Indiana wonderful new public fountains develop as these water mains burst and give us spectacular displays.

The infrastructure of our country which includes our railroads, although a large part of that is in the private sector, and we surely don't want to touch that, needs our most urgent attention. We cannot have a situation where we allow an imbalance to develop between the various parts of our nation in terms of the quality of the resources that are

available. If we want equality of opportunity for people who live in all parts of the country we can't have a situation where we can say "Sorry, we don't have good facilities in this part of the country. If you really want good facilities you have to move to Dallas, you have to move to Houston where federal subsidies over a long period of time have helped those areas develop."

You know, it is wonderful that the great godfather of all the conservatives, Barry Goldwater, can fly home to his federally subsidized airport, and turn on his federally subsidized water, and rant and rave about federal subsidies.

We have in our nation a need to rebuild, to strengthen the core capital facilities. Your organizations represent that kind of effort on an ongoing private market basis. But at the same time if we do not have the rebuilding of our highway network and if we do not have the rebuilding of our waterways and if we do not have the rebuilding of some of the competitors to your industry what we will have is them in a position really to underprice. We have to have higher taxes on our highways so that we can have the highways properly maintained. If we do not have the higher taxes in effect they are going to be able to price lower than the railroads for that period of time as the highways deteriorate, and that deterioration takes place rapidly.

We need a transportation network in this country that is sound and solid and integrated, but we are not getting enough attention to those kinds of issues. A lot of people see this as a chicken and egg problem. They say, "Well, you can't have the kind of development that you really need, because until we get the revenues we can't spend the money," but of course we will never get the revenues unless we spend the money in the first place. The chicken and egg problem is probably the greatest excuse that people have for not doing something.

Let me suggest to you today that there are no chicken and egg problems in this world; at least there are no chicken and egg problems in economics. Generally the difficulties that we see are not of the chicken and egg variety, but they are the variety of the lack of a rooster. You have to have people making noise, you have to have people doing things. If some of you take that as a sexist remark I don't ask for forgiveness. You have to have roosters out there who are willing to crow, or willing to make noise, or willing to indicate that things need to be done, and it is my hope that as you leave this two and a half day convention many of you will go back to your home stations, not to read *The Wall Street Journal* but to start crowing. Thank you. (Applause)

Mr. Marlow: Thank you, Mr. Marcus, for your very enlightening and lively talk.

Mr. Hernandez.

President Hernandez: Thank you, Mr. Marlow and Mr. Marcus.

At this time I would like to call President Denz to the rostrum.

President Denz: Next on our program we have a B & B Special Subject Report, Slide Control and Prevention, and I ask sponsor Director D. R. Ladner to make the introduction. Mr. Ladner.

Mr. Ladner: Thank you, President Denz.

This morning's subject will deal with Slide Control and Prevention. Our speaker today will be John Johnson. He is Division Engineer for the Atchison, Topeka & Santa Fe in Fort Madison, Iowa.

John is a 1975 graduate of Brigham Young University. He began his career with the Santa Fe in 1976 as an Assistant Engineer in Amarillo, Texas. He has since served as Assistant Roadmaster and Roadmaster. In 1979 he was promoted to Assistant Division Engineer in Fort Madison. In 1982 he assumed the position of Division Engineer in that office. He is a member of the B & B Association, a member of the Roadmasters and Maintenance of Way Association, he serves on Committee 22 of AREA, and he is a Registered Professional Engineer in Illinois and Missouri.

It gives me great pleasure to present John Johnson. (Applause)

Mr. Johnson: I gave one of these talks one other time, and it was on Wednesday morning. Now, how many of you are going to be here Wednesday morning? To couple that with the two previous speakers and their very dynamic remarks, I don't know, I might have the chance to give the prayer and have the Father give my talk, but other than that I don't know why I am here. I do have a talk, though, and I have some slides with it, and if we can have the lights down and the slides on we will get started.

SPECIAL SUBJECT NO. 3

Slide Control and Prevention

Chairman: J. M. Johnson, Div. Engr., AT&SF, Ft. Madison IA
Committee: H. E. Wiebler, B&B Supv., TP&W, E. Peoria IL
D. A. Bessey, Asst. Chf. Engr. Strs., Milwaukee Road, Chicago IL
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Introduction

As railway officers, we have all had our routine disturbed by slides. Landslides seem to be present wherever we have slopes, natural or man-made, with or without structures. Landslides often involve significant danger to life and property. This committee report on Slide Control and Prevention is not intended as a tool to solve soil/foundation stability problems, but rather is a discussion of the basic principles involving the control and prevention of these slides.

To accomplish this report, a questionnaire was prepared and distributed to committee members, various railway geotechnical specialists and some consultants and representatives for various companies dealing in special methods of slide control. I should mention at this point that I am not a specialist in geotechnical matters. The response to the questionnaire was good, and we obtained a wide variety of information from all these areas. In addition, we consulted various publications and basic texts. This report is based primarily on responses to the questionnaire from committee members and others.

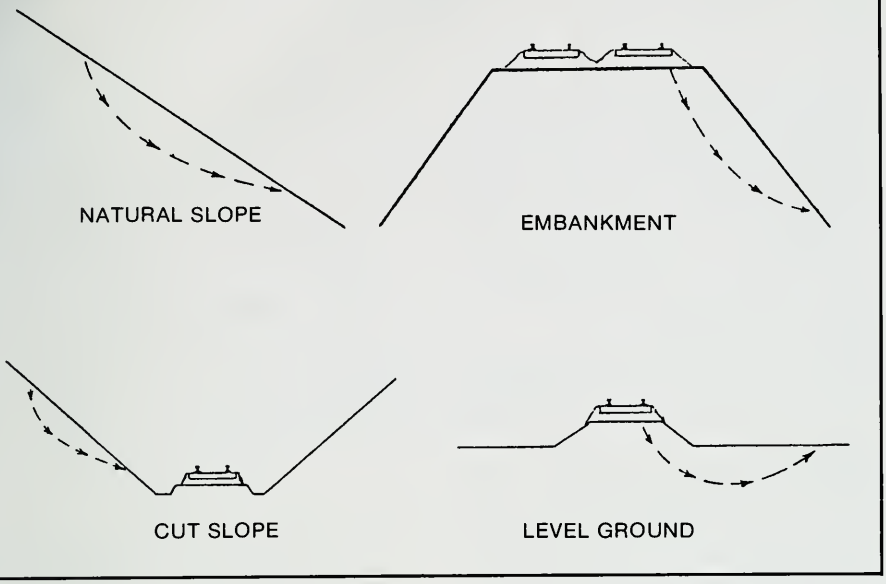
Most railroads in North America are built on solid old embankments and through stable cuts. Early engineers crossed and recrossed the country confronting a great variety of soil types, climatic conditions, and geological formations. By and large, they were very successful and much of what they laid out remains in use today. However, we are all aware that problem areas appear in the embankment and in cut slopes and require constant attention. It is interesting to note that many relatively new segments of railroad experience stability problems. It seems that many of us have a "line change problem" with which to contend.

As we begin this discussion, let us confine our immediate consideration to cuts and embankments in soil as opposed to those in rock formations. Failures in natural slopes, embankment cut slopes, and even level ground all involve the same basic mechanism. This involves the generation of a slip plane responsible for the actual movement of a mass of earth (see Figure 1). This slip surface is generated when the shear stress acting along that surface exceeds the shear strength of the material involved. Since the shear strength of the soil is intimately related to the presence of water within the embankment or the slope, the question of excess water is intimately involved with slide occurrence. Because of this, it is essential that the relationship of soil strength and moisture content be carefully defined for any given situation. Since soil strengths and slope geometry vary significantly with locations and situations, analysis of soil type is essential. As we discuss the basics of slide prevention and construction and slide control and prevention in maintenance, we must remember the intimate relationship between soil strength characteristics, soil moisture (drainage) and slope geometry.

Construction

We will consider construction factors only briefly for two reasons. First, construction is usually the domain of those with advanced degrees and a well-defined set of standards to assist them. Second, the basics have been well-defined and provide a proper foundation for construction. As previously indi-

FIGURE 1



cated, these basics involve consideration of slope geometry, soil strengths and drainage. Those with the advanced degree have produced many "tools" to solve slope stability problems.

These modern geotechnical tools assist us in the solution of particular problems. Among them are the following:

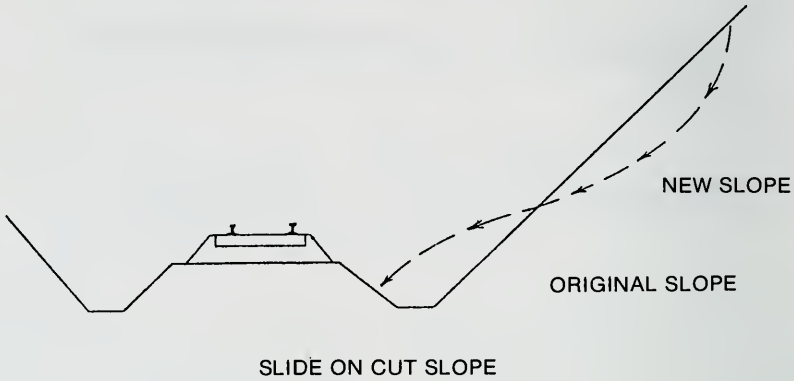
1. Lime stabilization
2. Grout/cement stabilization
3. Filter fabrics
4. Soil reinforcements
5. Structures—retaining walls, bridges, etc.
6. Drainage structures—french drains, perforated drains, etc.

Certainly we all realize methods and solutions to problems are as varied as the situations we face. However, even with the great variety of tools and techniques available to the modern engineer, we still have failures. Since none of us are in command of Mother Nature (and it seems she is capable of exceeding our expectations regularly), we will confront slope failures indefinitely. Even our best efforts at planning and building properly can be undermined by a sudden massive assault from nature.

Maintenance

For many of us, our main job involves the maintenance of existing structures, trackage and slopes. We must all remember that the structures, trackage and slopes (for which we are all responsible) are all subjected to varying operating conditions, weather extremes and foundation problems. Because of this failures are possible in a great many areas. However, we are assisted in protecting existing track segments by three basic factors. In the first place, many problem areas and slope failures are slow moving and therefore are often detected before a hazard presents itself. Secondly, we usually have an extensive history of the track segment in question, and we are aware of previous problems. Finally, all railroad trackage is subject to regular and faithful inspection, and this permits us to identify and correct problems before they become severe or hazardous.

FIGURE 2



SLIDE ON CUT SLOPE

Inspection

Inspection is of primary importance. Without it we would often be forced to solve problems of much greater magnitude than we currently face. Furthermore, safety would be diminished without regular inspection of the right-of-way. To locate possible slide problems, the inspector should check carefully from right-of-way fence to right-of-way fence. He should note any changes in the environment and should watch for clues that indicate active slides. On slopes, the inspector should watch for signs which might indicate the embankment is moving. Some of these signs include cracks in the slope, a loss of surface, bulges or heaves at the toe of the slope, and the rotation of the pole lines, trees, etc. Drainage conditions should be carefully monitored. The inspector should watch for locations of mud pumping which indicates embankment saturation. He should also be aware of any work involving slopes that might change the slope geometry. Often work done by outside parties or even company forces affect slope geometry. The inspector should be aware of extreme conditions such as heavy rains or high water.

Finally, he should consider the presence and influence of changes in vegetation or the presence of various animals which might affect the integrity of a slope. These indications and many others allow the inspector to locate slides.

Once a slide or potential slide is located, careful consideration must be given of how to proceed. The first consideration is the question of safety since the movement of trains must be protected above all. After safety, the relative hazards must be considered in light of the economic realities we face. A potential, even active, slide that does not currently present a hazard must be ignored while other more pressing locations are considered and dealt with. It is regrettable that less hazardous locations are often "patched" rather than actually controlled or repaired.

Control and repair of landslides

When we begin to consider the question o control or repair of landslides much discus

sion ensues. We are all aware of varying attitudes within and without the railroad industry concerning slide control and prevention. Our questionnaire responses indicated a great diversity of opinion even among Bridge and Building people. I have personally noted there are about as many solutions to landslide problems as there are people who come by to look at the problem locations. This is especially true with smaller projects or problems where many solutions are valid and where the economic impact is not significant. Even the economic issue is not always clear since our own operating conditions change frequently and Mother Nature is highly unpredictable. Often short-term solutions seem permanent while long-term solutions seem transitory. Therefore, let us consider a few of the problems and some of the solutions available to the railroad maintenance manager.

First, let us consider cut slopes. These slopes are frequently characterized by the absence of the active load and a lack of compaction. Slides are frequently caused by heavy rains which saturate the slope and weaken the soil. Since the soil is weakened, nature develops a flatter *effective slope* (see Figure 2). The typical cut slope fouls drainage and occasionally endangers the track and its adjacent structures. Because of these problems we frequently fall victim to a common trap. Using a ditcher or spreader we remove the toe of the slope. Too often, this steepens the slope even more and removes support from the bottom of the slope (see Figure 3). Because of this, one committee member indicated we should all take a torch to spreader/ditcher forms and cut them into little pieces! Actually, careful ditching is a necessary part of the repairs, but the entire cut slope should be considered. Drainage above and below the slope should involve the appropriate berms and ditches to prevent excessive moisture on the slopes. Moreover, consideration should be given to special drainage structures such as benches, downspouts, etc. in order to protect the slope from heavy precipitation. Vegetation should also be considered as a means of preventing erosion and controlling moisture content. However, trees should be removed since they do not contribute to slope stability and frequently overload the slope. At times slope stabilization with lime or by retaining structures may have to be considered to protect the slope, especially if there are space limitations.

On embankment slopes many of the same issues and problems involved with cut slopes are present. Once again, slides frequently occur as a result of heavy rains, since the saturated slope seeks to develop a more flat geometry. However, in this case the track structure itself is more often endangered. In this situation the common trap we fall into is to overload the top of the embankment. Successive track raises, slope widening, riprap, etc., all contribute to the overloading of many embankment slopes. We should also recognize that many old slopes were built at very steep angles creating an inherent hazard.

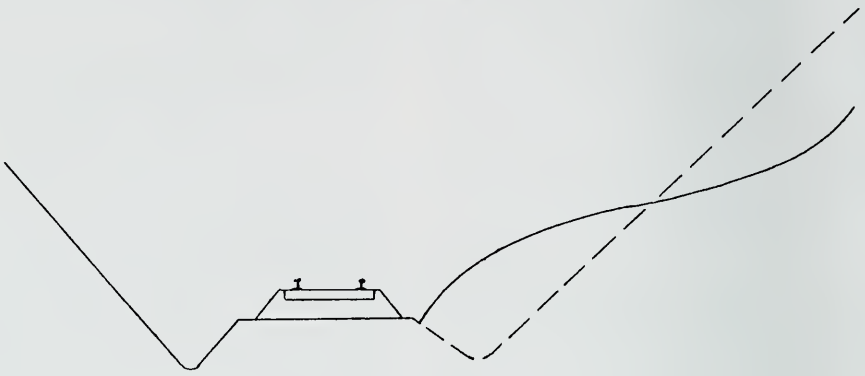
With embankment slopes the following factors should be considered in attempting to solve stability problems:

1. Avoid the *trap* of overloading the top of the embankment.
2. Avoid sealing the embankment with a nonpermeable addition to the slope.
3. Avoid cutting off the toe of the slope.
4. Avoid fouling drainage at the top or the bottom of the slope.
5. Avoid restorations with low strength materials.
6. Do carefully analyze the soil for strength properties.
7. Do carefully analyze the slope and its slide mechanism.
8. Do carefully locate the slip plane.
9. Do carefully restore or improve slope geometry.
10. Do provide proper drainage at the top, bottom and within the slope itself.

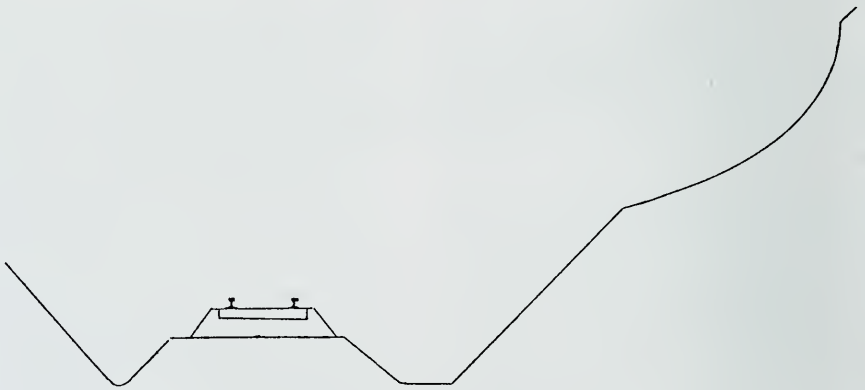
Careful application of these principles will greatly reduce slide hazards and will facilitate slide repairs when a failure does occur.

In restorations involving a complete slope failure, appropriate analysis is essential. The slip plane and cause must be located to properly resolve the problem. The next step is to remove the poor material which is often in a semi-liquid condition. Once that material is removed, the embankment can be restored with material obtained on the site or im-

FIGURE 3



SLIDE AREA PRIOR TO PERFORMING WORK

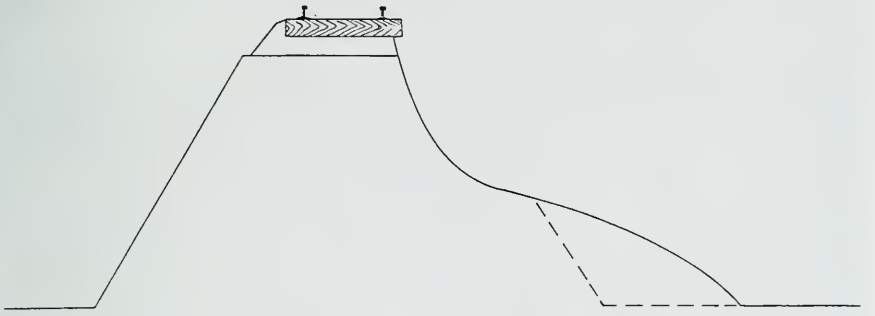


SLIDE AREA AFTER DITCHING

ported from another area. Either way, it is important to provide a material of adequate strength and permeability and to provide for proper placement and compaction, usually starting at the bottom of the slope. One response to our questionnaire indicated that a favorite method was to repair the slide using on-site materials and an appropriate mixture of lime to create an adequate strength. Lime slurry injection has also been used successfully. These methods all involve improving the strength of the embankment when it has failed.

Many other slides occur where the soil mass only moves a few inches or a few feet, and the embankment can often be restored to original stability without extensive removal of the failed material. As earlier indicated, however, it is essential that an appropriate and proper analysis be performed. In order to perform this sort of repair, movement along the slip plane must

FIGURE 4



CROSS SECTION OF EMBANKMENT SLIDE

be stopped and controlled. This is often performed by one or a combination of the following factors:

1. Strengthening the soil. Lime, lime slurry, grout/cement are all introduced into the embankment to strengthen the soil in place.
2. Dewatering. By reducing the moisture content we can usually improve the strength characteristics of the soil.
3. Modifying slope geometry and/or loading conditions. Slope flattening, berm removal or overloading conditions can all contribute to this area.
4. Structural modifications. Piling and retaining walls of various sorts can contribute to the control of an active slide. Materials of all types from rail to railroad ties to I-beams to wooden poles are used as piling. Retaining walls can be constructed from almost any material imaginable. Therefore reinforced earth, concrete walls (with or without tie rods), timber and piling walls, metal bins, rock wall, or filter fabric or geotextiles can be used to construct retaining walls.
5. Bridging. Occasionally, the only solution is to bridge all or part of a slide area to prevent further problems.
6. Relocation. Sometimes the most cost effective solution is to relocate the structure or track segment away from the unstable slope problems.

Many of these solutions to major failures are often quite expensive. It is far more effective to invest in proper engineering and maintenance *before* any failure actually occurs.

One committee member's response reminded us of the three basic factors in railway engineering, that is, drainage, drainage, and drainage. Because of its importance, additional comments about drainage are appropriate. Clay soils in particular are very responsive to water or moisture levels, and we should try to stabilize their moisture level. Once the moisture level is stabilized, we can design for that particular soil strength. Too frequently, we direct our efforts at attempting to solve a problem such as poor track surface or a slide or other deterioration without solving the real problem—poor drainage. Adequate drainage structures around and within a slope can contribute significantly to their stability.

After drainage, a comment about vegetation. While there are those who feel that trees contribute to slope stability, I do not agree. As indicated earlier, trees can seriously over-

load a slope and frequently their roots provide a ready access for water into the embankment. However, vegetation such as grasses or low shrubs can contribute to slope stability. Thus, while trees should be removed, other vegetation should be encouraged in order to protect the slope.

Conclusion

In summary, prevention of slides involves proper engineering, careful and economical use of the tools available, and proper inspection of the completed structure. In control and prevention of slides on existing roadways, careful inspection is of primary importance. In addition, drainage is absolutely essential. We must adjust the soil strength, and the slope geometry to conform to the soil strength and the moisture relationship at the location. Finally, we should utilize the available special structures as they are needed. We should remember that slides and their accompanying hazards will be with us forever. However, with careful engineering, we can reduce the occurrence and impact of landslides on railroad embankments and cut slopes. This involves the proper approach and the application of available tools to accomplish this.

President Denz: Thank you, Mr. Ladner and thank you, Mr. Johnson and those on your committee who provided data and worked to develop this interesting and informative report.

Copies of this and other special subject reports will be available at the rear of Room B later.

I respectfully return the rostrum to President Hernandez.

President Hernandez: Thank you, President Denz.

Again I would like to repeat that as of 10:00 A.M. the registration is as follows: Roadmaster members 137, B & B 49, Associate 166, Guests 45, for a total of 397.

I would also like to clarify the lapel pin controversy outside. The lapel pin is issued at the time that the Roadmasters pay their dues for 1984. The Registration Desk does not have the lapel pins.

We are getting ready to break for lunch and I would like at this time to inform you that the B & B will meet in Regency B at 1:15 P.M. and the Roadmasters will meet here in this room again beginning at 1:15.

I now declare this session adjourned.

MONDAY AFTERNOON SESSION
September 12, 1983

President's Address

By Omer C. Denz

Supervisor Building Maintenance
Milwaukee Road, Chicago IL

President Denz: Will everyone please be seated, and will someone advise those outside that the Bridge & Building session is about to begin. Please close the doors.

Good afternoon, everyone. I hereby bring this, the 88th annual conference of the American Railway Bridge and Building Association to order. First of all let me, on behalf of the Association officers and myself, extend a warm welcome to all you members, guests, and friends. I also want to take this opportunity to extend a cordial invitation to the women to participate in the ladies registration and programs and also to attend any session of this conference.

As required by the By-Laws of our Association, I am, at this time, required to render a report on the general condition of our Association. Our membership is 715, and this is an increase of 16 members over this same time last year. This is very encouraging.

As Mr. Hyma pointed out at our conference last year, the financial condition of the Association had eroded over the last few years on account of steadily increasing expenses and the decline in revenue. Since the savings fund was about to be depleted and there were no funds to be transferred, it was imperative we take steps to improve the Association's financial condition so as to stay solvent. The officers deemed it necessary to increase the annual dues to $15 and the conference registration fee to $20 this year. These fees are less than those charged by similar associations.

Changes have also been made in connection with the advertising and printing of the Association's Proceedings whereby better quality will be received at a lower price with earlier publication and distribution. We are hopeful that with these changes we will be able to continue to operate on a sound financial basis for an extended period of time. Because receipts from the advertising in our Proceedings are a major source of revenue, I suggest each of you take the time to review the list of advertisers and inform us of any other potential advertisers.

I would like to reflect back on our membership. Yes, increased membership is an important requisite to our Association, but equally important is the participation of the bulk of the membership in contributing to and participating in the development and distribution of the Association's special subjects and features including standing committee work. If this Association is to expand and excel as it should, more of its members need to motivate themselves or be motivated to take a more active role in the Association's functions, especially in connection with submitting recommendations for special subjects while both volunteering to serve and actively serving on committees of the special subject reports that are selected. We need and solicit your thoughts, comments, or suggestions relative to improving the Association and its functions.

Now, it is my pleasure to introduce the Executive members of your Association who will please stand as their names are called. Please hold your applause until all have been introduced. Beginning at my extreme right, junior director R. A. Tallent, Process Engineer Structures, Southern Railway, Atlanta, Georgia. Ray is Chairman of Standing Com-

mittee on B&B Training and serves on Special Subjects Committee. Intermediate director, J. W. Davidson, Assistant Director Bridge Engineering, Burlington Northern, Overland Park, Kansas. Jim is Chairman of Special Features Committee and serves on the Ladies Activities and Membership Committees. Junior vice president, J. M. Williams, B&B Supervisor, Elgin, Joliet and Eastern Railway, Joliet, Illinois. Jim is Chairman of Special Subjects Committee and serves on the Membership and Necrology Committees. On my extreme left, junior director, T. E. Kuhn, Engineer Special Projects, Missouri Pacific Railroad, St. Louis, Missouri. Tom is Chairman of Standing Committee on Materials and serves on Special Subjects Committee. Junior vice president, D. A. Bessey, Assistant Chief Engineer Structures, Milwaukee Road, Chicago, Illinois. Don is joint association representative and serves on the Conference Program and Proceedings Committee. Senior vice president, J. Budzileni, Senior Structural Designer, Illinois Central Gulf, Chicago, Illinois. Jim is Conference Program Chairman and serves on Advertising and Hotel Arrangements Committees.

I am not one for wanting to talk and draw out this part of the session, but I do want to tell the membership that I wish to thank them for allowing me to be an officer and President of this Association and for being able to know and appreciate the efforts of those who work so hard to keep the organization functioning and developing data and information that the membership and railroads can employ to improve their maintenance, construction, and operations. Again, I say "I wish I had become more active in this Association sooner."

Next on our program, is a special feature on the replacement of a bridge at Hannibal, Missouri. Mr. Jim Davidson, chairman of Special Features will make the introduction. Mr. Davidson.

Mr. Davidson: Our next speaker is Edward Bond. Ed is a graduate of Rensselaer Polythechnic Institute. After service with the Delaware and Hudson Railroad, he went with the Norfolk and Western Railroad in 1967 as Assistant Bridge Engineer. He is currently Senior Engineer of Structures. Ed has an interesting story about a bridge damaged by a barge collision—the sort of thing any of you with a bridge over a navigable river have nightmares about—and how the N&W restored it to service in record time. Now, here's Ed.

Presentation on the Replacement of Span E, Hannibal Bridge

By Edward Bond

Engineer of Bridges, Norfolk & Western

Members of the Association and Guests:

I have been asked to make a presentation on the replacement of the 246 foot truss making up Span E of the Norfolk & Western's Bridge No. 651, at Hannibal, Missouri.

This was not an anticipated replacement but one that developed very quickly starting Monday morning May 3, 1982, when the bridge was struck at 9:26 A.M. by the tug Northern King.

The Norfolk & Western's east–west mainline linking lines east of the Mississippi to the Kansas City gateway crosses the Mississippi River at Hannibal, Missouri, the usually tranquil town made famous by Mark Twain. Just north of the site of the jailhouse appearing in the stories of Tom Sawyer and Huckelberry Finn, our track parallels the river, then swings inland and then back toward the river at right angles to it, passing through a short tunnel, across the highway and Burlington

Northern, all within 50 feet, and onto Bridge No. 651.

The bridge as now exists, with the exception of spans E and F, was completed in 1888 by the Detroit Bridge & Iron Company for the Hannibal Bridge Company, a predecessor of the Wabash Railroad. It consists of four truss spans A thru D, each 176 feet in length; Span E, a 246 foot truss; Span F, another 176 foot truss span and Span G, the swing span with a total length of 358 feet. A 68 foot through girder, Span H, added in 1912, brings the total length to 1582 feet. All spans except spans E and H are constructed of wrought iron, and until the highway bridge downsteam was completed in the 1930's, it also carried vehicular traffic on a planked deck.

The masonry foundations for spans G and H rest directly on bed rock, the others on timber piling.

At approximately 11:00 the morning of May 3rd, the Assistant Chief Engineer-Construction, Senior Engineer Structures, and the Engineer of Bridges were notified that they would be receiving "instant vacation", as we call it in the N&W Bridge Section, at the river resort area of Hannibal, Missouri. With the help of a company jet we arrived at Hannibal shortly after lunch.

Slides 3 thru 16 illustrate what we found upon arrival at the bridge. Slide 3, looking upstream, shows the tug still tangled in a portion of the now submerged Span E, with some of its barges to the left. The other tugs shown were gathering the loose barges and moving them downstream to the waterfront at Hannibal. Slide 4 shows a closer view of these barges up against the downstream swing span pier protection cell. Slide 5 shows the barges removed but with the tug still caught in the truss wreckage.

This accident is typical of those we experience on the Mississippi and Illinois Rivers during spring high water periods with accompanying high water velocity, during which the barge operators are unable to maintain full control of their barges. In this case the operator claimed loss of control due to a partial engine failure. The barges first struck the cell shown in slide 6, then pivoted about this point with the current pushing the rear barges and tug downstream. The center barges then hit the cell at the upper end of the swing span protection just to the left of what can be seen of the shear fence. The tug then proceeded downstream hitting Span E, two spans from the swing span. The bridge operator who witnessed the accident indicated the tug went partially under the span and literally lifted it off the piers and then deposited it in the river only to become tangled in one end of the partially submerged span.

Slide 7 shows a view looking downstream with the swing span in the open position. Slide 8, shows an overall view of the bridge looking upstream. Slide 9 shows the tug still caught in the wreckage as seen from Span D.

Slides 10 thru 12 show the damage to the end of Span D. As you will note, much of the damage was caused by the rails being pulled against the end post. Similar damage did not occur to Span F as the rails pulled out of the Conley Joints located adjacent to the swing span. Slide 15 again shows the damage to the downstream end post on Span D from the rail being pulled against it. Slide 16 shows the conditions as I pointed out to the Division Engineer that he had one "heck of a low joint".

At this point the various options were considered. An alternate route, though longer and involving the Terminal Railroad Association of St. Louis, was available using our lines into St. Louis, and traffic had been immediately rerouted using this detour. Four practical options were considered:

1. Put in a temporary span using an old ICG swing span and replace it later with a newly constructed span.
2. Buy a retired bridge truss from another railroad and modify it.
3. Design and construct a new truss.
4. Modify design and specifications then held by Burlington Northern for one of their bridges, and construct a new truss using the already available engineering design.

It was decided to proceed with option 4 while using the St. Louis detour. The Burlington Northern was most helpful by permitting us to use the design for a 250 foot truss span designed to be installed at Pasco, Washington, by Howard, Needles, Tammen and Bergendoff. Arrangements were immediately made with Howard-Needles to modify the design for use at Hannibal. While this was being done, verbal bids were obtained for the fabrication and erection of the truss.

A contract for this work was awarded to Mississippi Valley Structural Steel, a subsidiary of Bristol Steel, who promised to have the span in place by July 31, 1982, just short of three months after the accident.

Slides 17 and 18 show Valley Line Supply and Equipment, our salvage contractor, at work removing the submerged span. At times this work had to be suspended because the water velocities were so high that divers could not work.

After two months of obtaining and fabricating the steel in their St. Louis plant, including full truss assembly on the shop floor, Mississippi Valley began to send steel to Hannibal for field assembly. They elected to erect the truss on barges a mile upstream of the bridge and planned to float the span into position, then lift the span using their 450 ton floating crane and set it into position, a method that had not been previously used to set a railroad truss of this size. On August 1st field assembly on the barges was complete and final erection scheduled for Monday, August 2nd. The 450 ton crane had been positioned at the bridge on the previous Saturday and used to lift the damaged corner of Span D while a section of the end post was removed and a new section spliced in.

Finally at 6:00 A.M. Monday morning, the bridge was ready to be floated downstream. Slides 21 and 22 illustrate Span E beginning her trip down river. It was quite a sight to see the truss and a accompanying crawler crane headed down river.

One of the major problems involved in modifying the Burlington Northern design was the difference in height required by modern rocker bearings versus the shallow rollers in use on the existing Hannibal spans. Shallow Lubrite bearings were substituted for the higher rockers.

As the new span floated down the Mississippi, workers anxiously awaited the closing of the gap that had existed for almost three months. Slide 28 shows the 450 ton floating crane in position for the lift.

Slides 29 thru 32 show the span being positioned to permit the crane to make a single lift, the span rotated to the proper alignment, and then lowered in place. The actual sequence of installation from attachment of the spreader to the placement of the truss is shown by slides 33 thru 39 taken from the park above our tunnel. The news media also wanted a closer view. Slides 41 thru 47 show the same sequence of events from track level. The painting of the span was incomplete at the time of installation, as workers prepare to start installing bridge ties. Slide 50 shows the floating crane after completing its works.

As soon as the span was in place navigation that had been temporarily suspended, was resumed.

Installation of the bridge ties was begun using tie panels that had been previously assembled on the Illinois bank of the river.

Slides 58 and 59 show the completed work awaiting the first train at about 6:00 P.M. The work was completed two days behind schedule, but in a record time of just under three months in spite of most engineers' predications that it would be a minimum of five months before completion. The Norfolk & Western feels that Mississippi Valley Structural Steel did an outstanding job in this accomplishment.

I will be happy to answer questions from the floor at this point.

Member: You mentioned you put in anchors above. What kind of anchors were put in?

Mr. Bond: Unfortunately I didn't see those when they were put in so I can't answer that.

Mr. Denz: Any more questions?

Member: What's the rating on the old bridge?

Mr. Bond: Well, of course we re-rated the bridge, and there's no one rating for the bridge because it depends on the individual components, but let me say that we have been running 315,000 lb. cars over the bridge. Although it's an old bridge it was designed very heavy for its time. The floor system has been replaced and that has strengthened it.

Mr. Denz: We thank you, Mr. Davidson and Mr. Bond, for your presentation. Next on our program is Special Subject Report No. 1, Replacement of Through Trusses, and here to make the introduction is sponsor, Ray Tallent. Mr. Tallent.

Mr. Tallent: Thank you Mr. Denz. Our next subject will be "Replacement of Through Trusses". This will be a *planned* replacement of through trusses—it's different from the one we just saw! This talk will be given by Mr. J. G. Bradley who is the General B&B Supervisor of Southern Railway.

Mr. Bradley started with Southern Railway in 1970 as a B&B apprentice and has worked his way up through B&B apprentice, mechanic foreman, supervisor to general supervisor and also during this time, he has found time to work toward a mathematics degree at the University of Southern Mississippi. Without any further ado, we have Mr. Bradley.

SPECIAL SUBJECT NO. 1

Replacement of Through Trusses

Chairman: J. G. Bradley, B&B Supv., Southern, Knoxville TN
Vice Chairman: T. L. Fuller, Reg. Mgr., Harland, Bartholomew & Assoc., Austin TX
Committee: W. B. Stanczyk, Str. Des., Milwaukee Road, Chicago IL
J. W. DeValle, Southern, Marietta GA
D. A. Bessey, Asst. Chf. Engr. Strs., Milwaukee Road, Chicago IL
J. C. Calhoun, Gen. B&B Supv., Southern, Chattanooga TN
D. J. Lewis, Sr. Str. Dsgnr., ICG, Chicago IL
H. Solarte, Gibbs-Hill, Dallas TX
R. J. Wright, Engr. Br. Des., Milwaukee Road, Chicago IL
R. G. Klouda, Chf. Drftsmn. & Clr. Engr., Milwaukee Road, Chicago IL
M. D. Murphy, Str. Dsgnr., Milwaukee Road, Chicago IL
M. P. Bhalakia, Desg. & Constr. Engr., P&LE, Pittsburgh, PA

In my presentation today, I will review the techniques to replace through truss spans with girder spans under traffic to include the type of equipment necessary, selection of materials and scheduling construction work with train operations. The following concepts will be discussed:

A. Replace through truss with open deck span using long girder spans.
B. Replace through truss with open deck span or ballast deck spans using short beam spans.

After the structure has been approved for replacement, the planning must begin. The local supervisor must work closely with the design engineer to assure that all areas of the project are covered before construction begins. Some of these areas are:

1. Permits from local, state and federal agencies.
2. Staging area for unloading and assembling materials, to include pile drive ramp.
3. Method of construction.
4. Scheduling the project.

Now we will look at these areas in detail.

Permits from local, state and federal agencies

At some locations, permits have to be obtained before construction can begin. Some of the agencies involved are the Corps of Engineers, U.S. Coast Guard, Environmental Protection Agency and TVA. These permits, in some cases, can take a year or longer to obtain, so they must be applied for early so a project will not be delayed.

Staging area for unloading and assembling material

The staging area should be located on or near the job site. It should be accessible to highway vehicles, to limit the amount of on

track time needed and to prevent costly delays when on track time cannot be obtained. If a hi-rail equipped, rubbertired crane is used, a ramp located as close to the job site as possible must be constructed to avoid excess travel time to the job site. Switches may have to be installed to handle movements of locomotive cranes. The staging area should be level and properly drained to avoid costly delays due to bad weather. The staging area should be large enough to accommodate all equipment and materials and provide ample room to assemble material.

Method of construction

There are many factors that determine the method of construction. Some of these factors are:

a. The type of structure to be replaced.
b. Can the existing piers and/or abutments be used.
c. Height of existing structure.
d. Terrain involved under and around the structure.
e. Type of equipment to be used in construction.
f. Type of structure replacing the through truss.

Scheduling the project

The project must be scheduled to allow sufficient lead time for all materials to be delivered before they are needed. A project can have costly delays if material does not arrive on schedule. All projects scheduled must be considered so men and machinery can arrive on the job site at the designated time. Replacing a through truss is a major project so the time of year and the related weather conditions should be considered before scheduling the project.

All the above areas have been covered and now the construction of the project begins. We will cover two construction methods to replace a through truss under traffic. The first method discussed will be constructing the permanent substructure before the trusses are removed. The second method discussed will be constructing falsework bents to support the existing structure and remove the trusses before the permanent substructure is constructed.

Replace through truss with 100-foot open deck girder span

The B&B construction gang is moved to the job site along with the machines and tools. A clearance ramp has already been constructed close to the job site if a rubbertired truck crane is to be used to drive the piling. If a locomotive crane is used, arrangements have already been made with the transportation department to obtain a spur track to clear the machine. The structure is now field measured for the placement of the new bents. A slow order is placed on the structure. The through truss must be altered so the piles can be driven. Certain components, lateral bracing, struts and portals of the through truss, may be removed so the piles can be driven. The rivets are removed from these components and replaced with A325 bolts. These components are removed when track time is attained and replaced before the passage of a train. Before the piles are driven, ribbon rail is removed and the track is panelled with jointed rail to the lengths of the spans. This can also be done after the piles are driven.

The preliminary work is completed and now the piles are ready to be driven. The type of piles to be driven depends upon the load design of the replacement structure and the subsurface investigation. Driving piles in a through truss is very time consuming because of the restricted head clearance of the crane. Swinging leads or fixed leads may be used. Fixed leads must have the ability to fold down to enter the through truss and raised up once inside the through truss. If the truss is high enough, the piles can be placed in the leads from underneath the through truss. If the piles must be set in the leads from the track, a smaller hi-rail crane is very helpful.

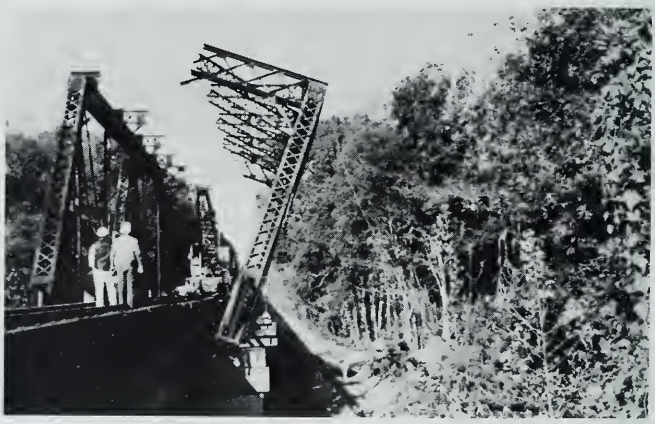
After the piling are driven, the bents must be aligned and braced. Angle, channel or H-piles may be used for the braces. Tower bents are involved, so experienced people are a must to obtain a professional job. The use of specialized equipment, such as hydraulic clamps, jacks, electric chain falls, spider staging and adjustable timplets are very helpful.

The bents are braced and the cut off is made at the proper elevation so the caps can be placed on the pile. H-beam caps or con-

Using derricks to set 90′ girder span after stringers and floorbeams have been removed.

Using locomotive crane to remove truss after spans have been set.

Completed structure using short beam spans.



Splitting and dropping truss members.

Completed structure using 90' girder span.

crete caps may be used. Special care must be taken to align and center the caps on the bents so the spans will fit properly.

Now the excitement begins, the spans are ready for placement. The length of the through truss will, of course, determine the lengths of the spans, but today we will place a twenty-five foot span, a hundred foot span and another twenty-five foot span. The ties and rail are placed on the spans in the staging area. They are prepared for movement to the job site before track time is attained. After sufficient track time is allotted, a twenty-five foot span is ready to be placed in the structure. One crane can be used to set the twenty-five foot span. Before the existing stringers are cut and removed, sufficient falsework must be placed to support the existing structure. The panelled track is now removed from the existing span. The existing stringers and floor beams in the twenty-five foot span can be removed in two ways.

The first method is to attach a four part spreader to the existing stringers and floor beams before the necessary cuts are made. Attach the crane to the four part spreader and when the cuts are made, remove the stringers and floor beams and place in the clear.

The second method is to make the necessary cuts to the stringers and floor beams and let them drop to the ground to be removed at a later time.

The next step is to place the new span in the structure, secure the spans with the proper fastenings and joint up the rail. After the track is cleared of machinery, train traffic can be restored.

After completion of the twenty-five foot span, the one hundred foot deck girder span is ready to be placed in the structure. Two cranes or two derricks must be used in this operation. Arrangements must be made in advance with the transportation department for sufficient track time and also the mechanical department if derricks are to be used to place the span. The span is loaded on heavy duty dollies and moved into the position in the through truss. The span is lifted from the dollies and the dollies are removed. The span is blocked up on the floor beams for safety. The rail may be removed at this time. The stringers connected to the floor beams are cut and dropped to the ground. The new span is held by the cranes or derricks and the floor beams are cut and dropped to the ground. The span is then lowered into position and secured with the proper fastening. Train traffic can be restored at this time.

The final twenty-five foot span can be placed in the structure using the same method as the first span.

The through truss is now ready to be dropped. The sides of the through truss are tied off and a machine hooked to each side. A crane, a front-end loader, or a dozer may be used. The struts and sway braces are then cut in half. The portals are cut last and the sides of the through truss are pulled down. The trusses may also be removed in sections, but the construction plan for their removal must be followed. The protective coating is applied to the new structure and the final clean-up is made.

The new structure is complete.

Reviewing techniques

The concept is the same in replacing open deck short beam spans as the twenty-five foot spans discussed in the previous sections. However, there are certain techniques that are different when ballast deck short beam spans are used. The same concepts are used to drive the piling as discussed in the previous section, but, using short beam spans, there will be more bents. A short H-beam cap is placed on the pile after the pile is driven and the cut off made at the proper elevation. The caps are welded to the piling and the four main stringers are placed in the structure using the same procedure used for the twenty-five foot spans previously discussed. Temporary timbers are placed between the ties and the stringers to maintain the proper track elevation until the deck cover can be installed and the ballast unloaded. The sides of the through truss are removed. The cap extensions are then welded to the short cap so the additional stringers for the ballast deck can be added. Depending upon the length of the short beam spans, the diaphrams can either be welded or bolted using A325 bolts. Huck bolts may also be used to fasten the diaphrams to the stringers.

After all stringers are placed and the diaphrams installed, the deck cover is placed in position. Steel plate, timber, or prestressed slabs may be used. After the deck

cover and track ties are installed, ballast is unloaded. The temporary timbers placed between the deck cover and the ties are removed, and the track surfaced. A protective coating is applied to the structure, and final clean-up is made. The job is now complete.

In the second method, falsework bents are placed to support the structure and the trusses removed before the permanent substructure is constructed.

The preliminary work is completed in the same manner as in the first method. The truss is modified according to the construction plans so piling can be driven for the falsework bents at specific points in the truss to support the floor system under traffic. The piling are driven. The bents are aligned and cut off at the proper elevation. Caps and braces are now installed. The floor system is blocked up on the falsework bents.

The trusses can now be removed. The construction procedure for the removal of the trusses must be followed. The procedure will vary depending upon the type truss and the location of the falsework bents. A crane is used to hold the member of the truss while it is cut and, after it is cut, move the member to a specific area for loading. This procedure is followed until the trusses are removed.

The permanent substructure can now be constructed. Piers and abutments may be constructed or piling driven. If piles are driven, the bents must be braced and the caps installed.

The spans are now ready for placement in the structure. The existing floor system is cut at the proper location to accommodate the new span and removed from the structure by the crane. The remaining floor system is supported by the falsework bents. If the through truss is replaced by an open deck structure, the bridge ties are now installed, but if a ballast deck structure replaces the through truss, the deck cover and track ties are installed and a temporary timber is placed between the floor cover and the ties to maintain the proper elevation. This procedure is followed until all the new spans are placed in the structure. On the ballast deck structure, the ballast is unloaded and the track surfaced to the proper elevation. A protective coating is applied to the structure and the final clean-up is made. The structure is complete.

Necessary equipment

The equipment necessary to replace a through truss with long deck girder span or short beam spans is:

1. **Crane.** The crane can be a rubber-tired crane with hi-rail capacity or a locomotive crane. The crane must be able to handle the pile driving operation. If a spur track is close to the structure, a locomotive crane can expedite the pile driving operation and setting of the spans. However, a rubber-tired crane can handle each of the above tasks very well. The crane size can be from 45 ton to 150 ton depending upon the type spans to set.
2. **Derricks.** These can be used when setting the long deck girder spans. Derricks work better than locomotive cranes or rubber-tired cranes because they can work with a short boom at a lesser boom angle; therefore, they are more adaptable to the confines of a through truss.
3. **Front end loaders or dozers.** Either machine is very useful when the sides of the through truss are removed. They can also be used to remove the remains of the through truss from underneath the new structure, so it can be loaded with the crane and moved from the job site. A winch mounted on these machines is helpful in pulling down the trusses and also in removing the remains of the through truss.
4. **Pile leads and pile hammer.** The leads can be fixed leads or swing leads and can be equipped with an air or diesel hammer. The main concern is to be certain that the leads will work in the confines of the through truss.
5. **Other equipment.** Welding machines are used because field welding of the caps, braces and steel deck plates are necessary. The falsework is also welded in some structures. A cutting torch is used from the beginning of the job to the end. When the spans are being set as many as four cutting torches are used at one time. A close inventory of oxygen and acetylene must be maintained because of the quantity used when a through truss is replaced. Various other small tools such as a power plant,

impact wrenches, huck bolt machines, chain saws, hydraulic jacks, etc., are necessary.

Importance of scheduling

One of the most important aspects of the job is scheduling the construction work with train operations. The local supervisor must work closely with the transportation department so that train interruption can be held to a minimum. On-track time is very critical when the spans are being set. If a good relationship is maintained with the transportation department, the trains can be rescheduled, so a window of time can be attained without delay to train traffic. If the derricks are used, work trains must be arranged and working limits established to allow greater working time at the job site. Work trains can also be used for the clean-up operation and unloading the ballast. As each of you know, our job is to move a train from point A to point B in a safe and efficient manner. By working with the transportation department this task can be accomplished and afford us greater track time and a smooth operation.

Careful planning and the correct execution of these plans will make the replacement of a through truss with short beam spans or long deck girder spans of safe operation.

President Denz: Thank you, Mr. Tallent, and you and your committee, Mr. Bradley, for a fine report. Now we have Special Feature No. 2 and I will call upon Senior Vice President Jim Budzilenia to make the introduction. Mr. Budzileni.

Mr. Budzileni: Thank you President Denz. Our next report will be on In-place Restoration of Timber Piles by David W. Brookings, Bridge Engineer with the Kansas City Southern Railway Company. Mr. Brookings graduated from Louisiana Tech University in August 1972 and in September 1972 started as Bridge Engineer with the Kansas City Southern Railway. He is a registered professional engineer in the states of Louisiana and Missouri and a member of AREA Committee 7 and of the American Society of Civil Engineers. Mr. Brookings.

Mr. Brookings: Thank you Jim.

In-Place Restoration of Timber Piles

By David W. Brookings

Bridge Engineer
Kansas City Southern Railway Company

President Denz and members of the Bridge and Building Association, I would like to express my appreciation for the opportunity to give this presentation this afternoon on a procedure the Kansas City Southern is using for the in-place restoration of timber piling.

The Kansas City Southern-Louisiana & Arkansas Railway System, which I will refer to as the KCS, extends due south from Kansas City, Missouri to the Gulf Coast. The KCS system has approximately 1,650 miles of track with 756 bridges. Timber bridges comprise 62 percent of this total, both in number and lineal feet, for an overall length of 15.46 miles of bridges. I have superimposed the KCS system map on this United States map depicting "above ground decay potential". The regions of decay shown are based on temperature and moisture with red indicating high potential; yellow-medium potential; and blue-low potential. Sixty-three percent of the lineal feet of timber bridges on the KCS system are in this "high decay potential" region. All of the slides you will see today were taken at bridges in this region.

Existing Posting Methods

Our existing posting procedure for changing out substandard piling consists of: 1) cutting old piling out at solid wood that is at or below the ground line; 2) framing a new post to be doweled to the stub piling; and 3) cementing a 3-foot metal joint consisting of a 21 inch or 24 inch diameter corrugated metal pipe that is filled with concrete. The metal sleeve and concrete combine to form a rigid joint that has performed very well. This slide shows a posted pile's sleeve which has been completely exposed by bank erosion. We prefer sleeved piles to a framed bent, as shown by this 5-pile bent with 5 posted piles. This bent has performed very well without any problems and has been in service about seven years. Although this method works well, it is both costly and time consuming, and may involve a large amount of digging.

Conceptual Idea and Experimentation

In 1978 Bob McGuire, Midwest Area Manager with the Osmose Wood Preserving Company-Railroad Division and LaMarr Smith, Engineer of Structures-KCS and myself were lamenting the fact that, although Osmose could stop wood decay with their in-place preservative treatment, there seemingly was nothing that could be done to restore the original cross section and strength of a timber pile. It was at this time that Bob shared with us four (4) instances where various methods had been used to restore timber sections to their original or near original load carrying capacities:

1. In 1960 on the timber approaches to the Cotton Belt Bridge over the Arkansas River at Pine Bluff, Arkansas, decayed drift pin areas were filled with wood and injected with epoxy.
2. In 1973 grouting was performed on timber piles using a technique developed by Darryl Bryant and Larry Green, both of the Frisco Railroad, now with the Burlington Northern. The Frisco had excellent results with this grouting program.
3. Bob had experience with epoxy injection into laminated timber beams.
4. In 1977 the Union Pacific had considered using an epoxy injection to restore timber caps, posts, and sills

on a vehicular bridge which was under their maintenance in Seattle, Washington.

These instances convinced us that, with some experimentation and testing, a functional, economical timber pile restoration could be performed.

In November 1979, six (6) timber piling that had been restored in June 1979 by Osmose in place on KCS bridge A-108 near Pittsburg, Kansas were posted out and taken to Kansas University in Lawrence, Kansas for testing. Six-foot sections were tested on their 200,000 pound capacity testing machine. Of these six piling, four that had been restored had test results that ranged from 196,000 pounds to 200,000 pounds (two of the piles could not be taken to failure). Two piling which were not restored but had large voids tested at 180,000 pounds and 200,000 pounds. Theoretical working loads on piling in KCS 14-foot panels with 5-pile bents are 55,000 pounds/pile.

We experimented with two different procedures in restoring these piling. The first sealed the exterior cracks on the piling with epoxy and were injected internally with low viscosity epoxy. The second wrapped the piling with Osmose Pile Gard, followed by injection with low viscosity epoxy. The results from these tests were good, but too much expensive epoxy was used. We would continue to experiment with other methods.

Epoxy/Sand Pile Restoration

KCS Bridge A-647 over Toro Bayou is a 758-foot long open deck timber trestle. The outriggers protruding from the deck were to support the recently laid welded rail. This structure was last driven in 1945 with southern yellow pine piling. Our bridge inspections and Osmose cruising reports in 1967, 1971, and 1975 indicated a very serious decay problem. Because of an estimated 30 percent reject piling, in-place preservative treatment was deferred and reconstruction was considered. The cost estimates in 1979 for a ballast deck concrete trestle was $700,000 and a replacement-in-kind timber trestle was $380,000. Bob McGuire, Osmose Railroad Division had cruised this bridge three times and suggested that the piling had excellent shell conditions, and, therefore, should be considered a candidate for in-place timber pile restoration, given the encouraging results of our testing at Kansas University in November, 1979.

Osmose internally treated the piling and caps at Toro Bayou in October, 1980. Internal decay was located in 86 percent of the piling and 35 percent were considered substandard. In March 1981, KCS contracted to have 103 substandard timber piling restored in-place. The following slides illustrate this work and the two methods we experimented with in the process. Bent heights vary from 12 to 15 feet except over three separate channels where they range up to 25 feet.

The two methods used here were: 1) Window method and 2) epoxy injection with pile wrapped in Pile Gard. The window method uses a cutout "window" section to allow access to the interior of the piling at the decay area. The window section location is chosen to avoid bracing and to remove the thinnest shell section on the piling. This removed shell is replaced with a treated tapered wood insert. Details of the window method, which we feel is the best method we have experimented with to date, will be shown later in this presentation. Numerous piling in this structure were classified substandard because of drift pin decay; these were repaired without cutting out any sound wood in the remainder of the piling. Also, there was a large number of piling with large voids from bottom of cap to groundline. Many of these voids were 7 inches to 8 inches in diameter in 12-inch diameter piling. It is important to note that where the restoration method is used around bracing hardware, the bracing hardware should be checked and tightened, and, if necessary, replaced before the restoration work.

The injection method uses Osmose Pile Gard wrapped around the decayed area of the piling to seal the exterior cracks and a low viscosity epoxy pressure injected into the void. This method of restoration was limited to void lengths of 30 inches or shorter because of the large amounts of epoxy used. We found that the epoxy would penetrate sound wood and the required quantities of

epoxy calculated from the void sizes were underestimated.

The in-place pile restoration has proved to be especially well suited to bridges where water problems would prohibit digging around the base of the piling or where there are several sets of braces framed into the piling. The time saving aspect is evident on quarter piles and center piles where no bracing is required to be removed, and the removal of the old pile and positioning of the new pile is completely avoided. At Toro Bayou we had 103 pile restorations performed at a cost of $60,000 compared to $380,000 for a new timber structure or $700,000 for a new concrete trestle. An extremely poor piling condition has been restored to near its original load carrying capacity.

Various other timber trestles in Southwest Louisiana had their piling restored in spring 1981. These slides show different locations where the pile restoration procedure proved advantageous over conventional methods of posting; i.e., high ballast deck bridges, and over deep standing water. There were numerous instances where only a one or two foot section was considered substandard, usually around a bolt hole, and we were able to avoid replacing large amounts of sound wood by simply restoring the one bad area. Shear connectors consisting of ⅜-inch diameter, 8-inch long ring shank drive spikes with washers are placed wherever the shell thickness is 3 inches or less. It is imperative that all pile restoration candidates have good sound shells with a minimum shell thickness of 1 inch at its thinnest section. Piling with severe shell rot or groundline decay are not suitable for restoration, and when required, are removed using conventional posting methods. In one instance, a substandard pile with a thin shell on one side for nearly its entire length, failed prior to in-place restoration, because a cap renewal on this bent apparently redistributed the loading. Good shell condition is mandatory for in-place restoration.

Testing with Epoxy Fortified Acrylic Grout

In looking for a manner in which to reduce the material costs of in-place pile restoration, we experimented with epoxy fortified acrylic grout at Toro Bayou. Six (6) piling were restored and then posted out, using our conventional method, then hauled to Madison, Wisconsin for testing at the Forest Products Laboratory.

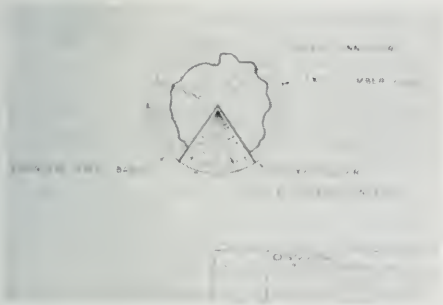
In 1981 the epoxy/sand procedure used for the restorations was priced at $590/pile. Epoxy usage was approximately double what was estimated from the void sizes, indicating the epoxy was penetrating sound wood. With impending increases of some 40 percent in the price of epoxy, we felt that there was a need to continue experimenting with a less expensive material to keep costs down and avoid an "overkill" from a strength standpoint. We compared at Madison piles restored with:

1. Epoxy/Sand
2. Epoxy fortified acrylic grout

Basically, what we were hoping to do was to verify that the less expensive grout mixture would give us adequate strength in the restored pile and to determine how it compared to the epoxy/sand mixture which we knew worked well. The epoxy/sand sections tested to 265,000 pounds and 191,000 pounds, while the epoxy fortified acrylic grout sections tested to 265,000 pounds and 303,000 pounds. Comparison of the two mixtures indicated we had not lost any strength with the acrylic grout and still had a good safety factor over the required 55,000 pounds working load. An eighteen-foot section was tested to more closely approximate field conditions. The pile actually failed at an undetected bolt hole decay area that was below the groundline and behind a sway brace and, subsequently, was not repaired. The pile was recut to seven feet and retested with results comparable to the previous results. In this slide, with the hat, is Andy Anderson, Osmose's Manager of Operations, who has been instrumental in working out procedures and mechanical details for the pile restoration program.

In-Place Pile Restoration Reporting & Specifications

Currently, we believe the "window method" of pile restoration gives us the quickest, most economical, and most functional method of restoration. The next three



Cross-section of restored piling

Void is filled and grout flows from air hole

Grouting in progress with epoxy fortified acrylic grout.

Pile restoration procedure requires no brace removal

Typical restored piling "window method"

slides will illustrate the components and cross-section of the restored pile and the report Osmose furnishes us at the conclusion of the work. In this general view, the components required in the "window method" are diagrammed: 1) 1-¾-inch diameter grout hole; 2) 1-¾-inch diameter air hole to avoid pressure build-up in the void; 3) 1-inch wide, 18 gage stainless steel band placed 6 inches above and below ends of window insert; 4) 1-inch wide, 18 gage stainless steel band every 2 feet; 5) ⅜-inch diameter, 8-inch long ring shank drive spikes with washers placed where shell thickness is 3 inches or less; 6) treated timber insert; and 7) epoxy sealer to seal crack between pile shell and timber insert. In cross section, a restored pile would appear as shown here. The report which we receive on each pile spells out the shell thicknesses, the sizes of the decay voids, and the location of the window section. The drilling pattern for inspection is four holes at right angles to one another at one foot intervals for the entire length of the void.

In-Place Pile Restoration—1983

The following slides will show the in-place pile restoration procedure from start to finish using the "window method". The slides were taken in May 1983 at our Neches River Bridge in Beaumont, Texas where we have joint trackage with the Missouri Pacific and Southern Pacific. Rail traffic here is about 25 trains daily and 35 million gross ton-miles annually.

By necessity all the equipment is at one end of the bridge because of the high river level. Ordinarily, Osmose plans to move equipment along beneath the bridge on bombadiers. The only equipment required other than small incidental tools is the bombadier, grout machine, and air compressor. The drilling pattern used to outline the decay is four holes at right angles to one another at 1-foot intervals, and from this information the location for the window is selected. On this particular piling it is drift pin decay, and the window has been marked with blue chalk for cutting. As stated previously, the window location is normally chosen at the thinnest shell section to aid the cutting and to repair the weakest wall section and, also, to miss any existing bracing. Cutting the window with a 12-inch bar chain saw, this 4-foot section took about 10 minutes. We found out the hard way that we should measure the wedge insert first and mark the window to be cut to fit the wedge. You can see in this slide the drift pin in the top area. All loose and punky wood is removed from the inside of the piling with a scraper and wire brush.

Work is performed under rail traffic as seen here; however, it is our policy not to work on more than one piling in a bent at the same time. The timber wedge is fitted into the window section, and the edges of the window and wedge are buttered with epoxy sealer. Stainless steel bands are applied at two-foot intervals, and then the joint between the shell and wedge is sealed with epoxy. This pile is now ready for grouting and actually has two separate areas to be grouted. Note how the window section was chosen on different faces to eliminate the thinnest shell section. This location was unusual in that the piling had decay below the groundline because of previous silting in by the river and no decay in the brace bolt hole areas.

The epoxy fortified acrylic grout mixture contains 4 gallons water, 2 gallons epoxy fortifier additive, one 94-pound bag Type I Portland cement, and one 100-pound bag of sand. As the grouting progresses, the shear connector holes will serve two purposes: 1) provide location for the shear connectors and 2) provide inspection holes to follow the progress of the grout and inspect the consistency of the grout mix. Two men follow the progress of the grout and drive the shear connectors. A final check is made on the grout when it begins passing through the air hole. Treated tapered plugs will be placed in both the grout hole and air hole.

At the Neches River Bridge it was necessary to lay out the grouting line to facilitate the work over water. On this particular pile, which is in fifteen feet of water, the restoration extended from bottom of cap down to waterline. Considering the water depth, several sets of bracing, and train traffic at this bridge site, conventional posting or redriving would have been extremely difficult.

Summary

In comparing repair times between conventional posting methods and in-place pile restoration, site conditions obviously govern production rates, but in the spring 1981 an average of 5 piles per day were in-place restored. When posting, the maximum production we can expect is two piles per day, and this is subject to decrease where bracing, heavy digging, ballast deck structure, or heavy train traffic are involved. By increasing their mobilization with three bombadiers rather than one, we hope to increase the restoration output to seven or eight piles per day. Costwise, conventional posting costs a minimum of $1800 per pile. In 1983 the restoration cost $690 per pile for eight feet or less and up to a maximum of $1470 per pile for a 24 foot section.

Current KCS policy on the degree of application for in-place pile restoration candidates is as follows:

1. Only substandard piling are considered. These are determined by Osmose during in-place preservative inspection and treating.
2. Minimum shell thickness of 1 inch.
3. Piling must be internally treated before it is restored.
4. No void less than 4 inches in diameter is restored.
5. Osmose foreman makes determination from field drilling and decay plot as to substandard candidates, and a report is submitted to our office for review.

Restoration work can*not* be performed under the following conditions:

1. Severe groundline decay exists.
2. Pile shell thickness must be a minimum of 1 inch thick and have no large checks or splits.
3. Dump bents where access is extremely limited.

Our experience these last two years has been that about 75 percent of the reject and possible reject piling can be restored using the window method. The remaining 25 percent are posted using conventional methods.

We certainly do not view in-place pile restoration as a "cure-all" for poor timber substructures, but do conceive it as one functional and economical means of prolonging the life of timber piling that will continue to be subjected to heavier and more frequent loadings. We are also realistic in the knowledge that in-place pile restoration is not a betterment to timber bridges, but rather an approximate return to its former load carrying capacity. Should an existing timber trestle no longer function at a particular location, then obviously in-place pile restoration would serve no purpose. We expect to continue experimentation to improve strength, production, and to make the process as economical as possible.

The idea and concept of restoring timber piling is neither new nor its procedures exotic, but in the 1980's no one talks of timber railroad bridges in terms of new or exotic either!

President Denz: Thank you Mr. Budzileni and Mr. Brookings for your enlightening and very timely report. Next on the agenda is Special Subject No. 4 which will be introduced by the sponsor, Director Tom Kuhn.

Mr. Kuhn: Thank you President Denz. Our next subject will be Special Subject No. 4 Environmental Compliance and How It Affects B&B. The committee that prepared this report was chaired by Mr. W. P. Cunningham, who will present this report. Mr. Cunningham received a Bachelor of Science Degree in Civil Engineering from the University of Missouri at Rolla in 1973 and joined the Missouri Pacific Railroad Company that same year as Assistant Utilities Engineer. In 1976 he was promoted to the position of Utilities Engineer which position he still holds. He was also active in the U.S. Army Reserves from 1973 to 1980, obtaining the rank of Captain. I now ask Mr. Cunningham to present the report.

Mr. Cunningham: Thank you and good afternoon.

SPECIAL SUBJECT NO. 4

Environmental Compliance

Chairman: W. P. Cunningham, Utilities Engr., MP, St. Louis MO
Committee: H. J. Laga, Asst. Envr. Engr., C&NW, Chicago, IL
R. E. Fronczak, Dir. Env. Cntl., Milwaukee Road, Chicago IL
P. C. Conlon, Mgr. Env. Studies Divn., AAR, Washington DC
T. E. Kuhn, Engr. Spec. Proj., MP, St. Louis MO

In the past ten to fifteen years, federal, state and local regulations have become more concise and ofttimes burdensome as they relate to environmental matters. While most railroads have met this attack of cumbersome regulations by the staffing of an environmental department, the brunt of complying with the regulations has generally fallen upon the B&B employee. Exactly how environmental compliance affects B&B operations throughout our industry is a little difficult to pin down because each railroad can assign work to different crafts depending upon historical factors and prevailing labor agreements. This presentation, therefore, is an overview of the various environmental problems typically found on most railroads and which may affect B&B operations.

Diesel fuel spillage

Probably the first thing that springs into mind when "environmental" and "B&B" are mentioned in the same breath is locomotive fueling and the spillage attendant to it. While the actual operation of putting the fuel into the locomotive is seldom performed by B&B forces, they are usually involved in providing the basic system required to store diesel fuel and deliver it to the locomotive. This usually includes storage tanks, piping systems, pumps, hoses, and nozzles.

Environmental considerations aside, the present high cost of diesel fuel would make it imperative to control fuel losses due to leakage and spillage that would be attributable to the fuel storage and delivery system. Such operations as pressure testing of fuel pipelines to detect and repair leaks, maintenance of packing and gaskets in valve and pipe joints, along with pump seals to prevent leaks, maintenance of storage tanks to prevent corrosion, leakage, or failure, replacement of worn out or defective hoses and nozzles and changing fuel filter cartridges may be B&B functions that definitely have an impact on both the environmental and economic considerations in the fueling operation.

Practically every railroad employs some type of automatic shutoff system in the fuel nozzle to stop fuel flow at a predetermined level before overfilling the tank. It used to be common practice when fuel was 5 to 10 cents per gallon to fill the tank until fuel spilled out the overflow pipe. Both the economic and environmental considerations made the automatic shutoff nozzle attractive, if not mandatory. B&B forces responsible for maintenance and repair of nozzles generally are required to make every effort to maintain the automatic shutoff protection and to repair defective or leaking nozzles as soon as practicable. A good working relationship with the user department should be developed in order that defective equipment is reported as soon as possible along with making them aware of the importance of proper handling of the nozzles to prevent leakage and spillage.

Engine servicing and refueling areas may typically be protected by an impervious surface such as metal or fiberglass track pans and concrete slabs, or by oil- and water-impervious engineering fabric installed below the track structure and having subsur-

face drainage. These systems are installed for the purpose of preventing contamination of the groundwater, and as such need to be maintained in an operable state so as to avoid complaints from the authorities. Such things as cleaning sand and trash from the sewers can pose a significant burden to the B&B employee. Once again, if a good working relationship can be developed with the other crafts to make them aware of the problems, this burden could be reduced tremendously.

Most railroad yards are filled with cinders that tend to accelerate corrosion of buried pipelines. Pressure testing of pipeline provides one of the most effective methods detecting the presence of leaks in pipelines. B&B forces responsible for pressure testing pipelines should first consider pump packings and valve seats as possible sources of leaks. Having eliminated these sources, the buried line itself should be isolated then checked for leakage.

Frequently, buried piping systems lack connections to allow for easy pressure testing, generally resulting in tests not being made at all. One railroad reported a leak in the fuel pipeline, located between a one million gallon storage tank and the fuel pumphouse, that resulted in a spill of several thousand gallons. When the source of the leak was uncovered, a quarter of an inch diameter hole was found. The cost to install connections at each end of the pipeline for testing along with performing tests on an annual basis would easily have been justified on the basis of this several thousand gallon leak, including the cleanup costs.

When pressure tests are made, there can be no excuses for leakage. While practice varies within the industry, satisfactory results will be obtained if a pressure of at least 110% of that which the line is normally operated at is maintained for a period of two hours. If the pressure does not hold, the source of the leak should be found and repaired. One railroad has reported that they have recovered nearly 400,000 gallons of fuel as a result of detecting a leaking underground fuel line. Leaks need to be stopped.

The installation of fuel oil piping having a protective coating should be circumspect if the design of the piping installation has not taken into consideration cathodic protection. Quite often a steel pipe installed without a protective coating in ground having a very low resistance will last longer than a pipe having a protective coating. Unless a line is known to have been cathodically protected when installed, the B&B employee would be wise to have an expert in the field inspect the piping system for possible corrosive actions.

Fuel oil storage tanks should be inspected regularly for evidence of corrosion, cracking, defective connections, or other sources of leakage. Safety devices such as fire emergency valves with fusible links, vents, and gauges should be checked to assure they are still operational.

A common point that is frequently overlooked is the foundation of large steel fuel storage tanks. One railroad had the experience of a 600,000 gallon tank, which had been constructed only on a compacted subgrade, developing a leak as a result of flexure of the steel at a welded joint where the compacted material had washed out from under the edge of the tank. A new floor had to be installed in the tank, grout pumped under the old floor to provide for a sound foundation, and a concrete ringwall installed under the edge of the tank. If this problem had been spotted earlier, several thousand dollars would have been saved along with not having the tank out of service for several weeks.

Spill Prevention Control and Countermeasure (SPCC) Plans

Current environmental regulations require Spill Prevention Control and Countermeasure (SPCC) Plans for oil storage facilities that meet certain capacity requirements. While the determination of which facilities require plans along with the actual preparation of the plans is generally handled by the railroad's environmental department, a vast number of B&B employees and supervisors will be called upon to implement the procedures mandated by the regulations and incorporated in the site specific plan and, therefore, should be familiar with the requirements.

While the actual content of the written plan along with having it at the specific storage facility is important, its implemen-

tation by the B&B is what counts. Several key points are important regardless of the need for a plan. Oil storage facilities should generally be equipped with secondary containment such as dikes and levees or, absent such containment, should have the ground sloped so that any spills will drain to a properly designed treatment plant.

Dikes should be constructed of impervious materials or sealed with an impervious material such as bentonite. Bear in mind that some means should be provided to remove accumulations of rainwater that fall within the dike and which, if left there, can reduce the effective volume of the dike. The rainwater may contain pollutants and should be treated appropriately.

In the event a spill occurs that will not be accommodated by existing treatment systems, personnel, material, and equipment need to be brought to bear in containing and ultimately cleaning up the spill.

The first priority of personnel arriving at a spill scene, should be to stop the spill from entering water courses. A man with a shovel can do a tremendous amount of building dikes in ditches and around manholes.

Absorbent material, surface skimmers, and floating booms should be available for collecting the oil spillage. If these materials are not stocked by the railroad, then local suppliers of these items should be known in advance for such emergencies.

Booms are useful in containing oil which has already entered a water course and facilitate skimming. Siphon dams are useful in containing and collecting oil in ditches.

Large quantities of spilled oil should be pumped to a storage vessel of some sort. In some cases, recovered oil storage tanks at the treatment facility could be used. In others, it may be necessary to call a local spill contractor for help.

After being used, cleanup material should be collected and disposed of properly.

The main thrust of all of this, insofar as it affects B&B foremen and supervisors, is that there is a requirement to be familiar with applicable regulations, to implement spill control and containment countermeasures as quickly as possible, and to dispose of fouled materials in an environmentally acceptable manner.

Waste treatment systems

B&B forces are also generally involved in the construction, operation, and maintenance of oil separation and wastewater treatment facilities. These are usually provided at a fueling facility or a mechanical facility. By and large, a collection system, consisting of an impervious surface at the fueling location or shop facility, a drainage system to carry waste liquids to the treatment plant, a separator or treatment plant, and a storage tank for recovered oil are the major components of the facility. While design of these facilities may not be in the scope of the majority of the members of this organization, the operation and maintenance of the facilities usually are. If it is, it should be the concern of those charged with this responsibility to learn the method of operation and measures to be taken in case of malfunction. Similarly, discharges from treatment plants are usually regulated by federal, state or local permits and the water quality and reporting requirements incorporated in the permits should be attended to by those charged with this responsibility. These treatment facilities also generate quantities of waste oil and sludges that must be disposed of in compliance with applicable laws and regulations. Oftentimes, the waste oil collected provides a source of fuel for boilers, furnaces and stoves.

Bridges

Another area of B&B operations that may be affected by environmental regulations is the maintenance and construction of railroad bridges and trestles. This is an area of vital importance in the day-to-day operation of the railroad along with having an input on personal safety of the B&B personnel. Although there is an increasing trend toward building permanent bridge structures that require less maintenance and are less vulnerable to fire and deterioration than timber bridges, the use of treated timber in or on bridges is still an area of major environmental concern to railroads today because of the use of chemicals to preserve the wood.

Creosote and pentachlorephenol pose a considerable environmental problem, particularly creosote. The personal hazards

posed by creosote are familiar to everyone in this industry, especially those with personal knowledge of creosote burns. Personnel coming in frequent contact with creosote or penta should be fitted with proper clothing and gloves so as to avoid skin contact. However, disposal of scrap or secondhand timber materials, in light of environmental considerations, may be a problem, even to the B&B. In most areas, timber cannot be burned because of clean air regulations, and the scattering of whole pieces or chips on the right-of-way frequently is prohibited because of the fire hazard it represents. Using it for an alternate energy source is not sufficiently refined to be economically attractive at this time; however, one railroad does burn scrap timber in a large shop boiler as an available method of disposal. Unless the timber can be sold to a contractor for landscaping, about the only generally accepted alternative left is hauling to a landfill. Even then the landfill should be checked to ensure that it is approved by the State, or the possibility exists that the material may have to be removed and hauled to another site as one railroad has experienced.

Bridge coating and painting of steel structures pose some unique problems. The lead and chromium contents of certain paints makes their use questionable. Consideration of air and water pollution regulations affect how surfaces to be painted are cleaned. Sandblasting, particularly over water, is still a commercially acceptable method of preparing a surface for painting, but consideration is required as to where, when and how it is done. Personal protection for those involved in the process is also required in the form of masks and goggles. Disposal of residues of solvents and paints as well as empty containers must be done in accordance with applicable laws and regulations. No longer is the indiscriminate discarding of paint sludges and drums along the right-of-way acceptable. Unless the paint/solvent mixtures and drums are recycled, disposal in landfills generally is required along with the resultant administrative burden, not to mention the cost.

Vegetation control

Vegetation control, along the right-of-way in general, but for this report, specifically around and under bridges, is an area subject to considerable regulation. Only herbicides approved by EPA for railroad type applications should be used in addition to following the manufacturer's recommendation when applying such herbicides. Many products call for the use of respirators and protective clothing during mixing and application of the herbicides; however, most herbicides approved for use by railroads do not require such protection. In addition to protecting the B&B employee, emphasis should be placed on the significant liability that exists in spraying on windy days, over bodies of water, near sensitive ecological systems and urban areas. This is also important from a public relations standpoint. Used drums or containers of banned herbicides such as 2, 4, 5-T should be disposed of in accordance with applicable regulations which generally necessitate hauling to an approved landfill. As an alternative to landfilling, one railroad has found that while certain herbicides are prohibited in railroad applications, they are allowed in others; therefore, they have been able to exchange the banned herbicide for an approved one.

Outfit cars

Housing of maintenance of way personnel, in addition to B&B, in remote locations in bunk cars is an area of unique concern to B&B personnel. Providing storage of potable water, sanitation, and disposal of liquid and solid wastes are typical problems. The various railroads address these in a variety of ways. Some provide packaged drinking water, portable toilets, and holding tanks for kitchen and shower wastewater. With requirements varying from state to state and even within a state, it is difficult to have one system acceptable throughout the industry.

As long as good clean potable water is provided and common sense sanitation for the employee and general public is regularly maintained, it is hard to go too far wrong.

PCB Transformers

Existing regulations covering toxic substances have received a significant amount of attention in the recent past, with oil-filled

transformers being of particular concern to some B&B supervisory personnel. Most railroad owned, oil-filled transformers up to just a few years ago contained polychlorinated bi-phenols (PCB's). In general, transformers, capacitors, or other electrical components containing PCB's in an amount of fifty parts per million is regulated. Transformers that are suspected of containing PCB's should be analyzed and, if found to contain PCB's, must be properly labeled as containing PCB's. Transformers containing PCB's must be inspected regularly, basically for leaks, and records maintained as to inspections and servicing. Transformers or other equipment containing PCB's taken out of service must be stored in an area protected from rain, contained within a diked area without floor drains, and not within the 100 year flood plan. Inspections and record keeping are also important for stored items. While the testing, inspection and recordkeeping of PCB transformers is burdensome, environmental considerations alone may dictate that the PCB contaminated oil be disposed of properly and replaced with an acceptable oil. As there are only two or three approved disposal sites in the country at the present time, the handling and disposal of PCB's from several thousand transformers, as one railroad has found, could run into the hundreds of thousands of dollars. Improper handling, recordkeeping, disposal, etc., could be even more costly, considering potential lawsuits, fines and cleanup costs.

Disposal of waste material

Present regulations have become very restrictive regarding disposal of all waste material, especially if it is classified as hazardous. Some states, as an example, require that generators of most wastes, including hazardous wastes, be essentially registered and with the requirement of filing annual reports to the state of the types and amounts of wastes generated. Such hazardous wastes which may be generated on a railroad consist of spent solvents from parts cleaning, lye vat wastes, soil contaminated with creosote, PCB oils, and paint/solvent sludges. In order to ensure the proper handling of the specific wastes classified as hazardous, a cradle-to-grave approach has been developed whereby the wastes are manifested at the point of generation and tracked to the point of final disposal. It is imperative that drums containing hazardous substances not be dumped on the ground after using. In addition, many containers having as little as only one inch of hazardous substance should be treated as a hazardous waste unless the container is beneficially reused or recycled. For example, a container of creosote would be considered a hazardous waste if only one inch of creosote remained in the drum. It pays to get out every last drop for more than just economic reasons. Even drums that have been "drained" should not be allowed to be used for trash or for burning trash unless the drum has been properly cleaned out. As an example of a potential problem in improper handling, one company reported being sued by employees due to the "toxic fumes" being given off from a drum being used for heating during a cold winter's night.

Sludges and sand removed from oil separators, sewers, and engine-servicing platforms are not generally considered hazardous wastes. In years past, common practice was to haul this oily material to some low spot in the yard which was being filled. While this method is still being used, there are more environmentally acceptable means for disposal of this material. The easiest, though generally most costly, method of disposal of this material is by hauling to an approved landfill. With tightening of existing regulations and a decrease in the number of approved landfills, many railroads have begun hauling their own sludge to central points on their system for dewatering and/or further treatment. Some states have allowed these wastes to be land farmed, i.e., spread in very thin layers on a field and disced into the soil. While many B&B employees are actually performing these operations, supervisory personnel should be familiar with current approved disposal methods so that costs may be kept to a minimum while at the same time complying with current environmental regulations. If there is any doubt as to proper handling of the material, the railroad's environmental department should be contacted or the appropriate environmental agency.

Groundwater cleanup

B&B employees are actively engaged on several railroads in the cleanup of groundwater which had become contaminated from many years of oil spillage at engine-servicing facilities. They have assisted in planning and construction of soil borings, monitoring wells, and groundwater recovery wells. Once the borings have determined the extent of contamination, quite often they are utilized as monitoring wells which will ensure that the extent of oil contamination does not increase. The recovery wells, which are then strategically located within the area of contamination, are then pumped in order to remove both the oil and the groundwater so as to create a depression in the water table. The close supervision over the operation of these recovery wells, along with the maintenance of the pumps and piping, is then frequently handled by the local B&B employees. Depending upon the rate of recovery of the collected oil, product removal from the storage tank must be coordinated with a local scavenger or with the railroad's own tank car fleet for transporting to a central power plant.

This report has been only an overview of several environmental problems affecting many of the membership of this Association. The B&B employee needs to be made aware of the need for compliance with the multitude of environmental regulations, even though the problems encountered frequently are not easily resolved. Once he is aware of the need for environmental compliance, he will be better armed in solving the problem, even if the solution is nothing more than requesting assistance from his supervisor or his company's environmental department.

President Denz: Thank you Mr. Kuhn and thank you Mr. Cunningham and your committee for its good and timely report. I certainly am aware of and appreciate the problems you encountered in preparing that subject. Copies of all special subject reports will be available at the rear of this room. We are at the end of today's program and if there are no questions, I hereby adjourn our meeting until the joint sessions reconvene at 8:30 a.m. tomorrow.

TUESDAY MORNING

September 13, 1983

The Tuesday Morning Joint Session was called to order at 8:30 A.M.

President Denz: Will everybody please be seated. Those out in the corridor, please come in.

The second Joint Session of the Roadmasters and Maintenance of Way Association and the American Railway Bridge and Building Association will now come to order.

Ladies and gentlemen, members and guests, on behalf of the Roadmasters and Bridge and Building Associations I welcome you to the second Joint Session of the Conference here in Chicago. Registration this morning is Roadmasters 172, Bridge and Building 78, Guests 83, Associates 260 and Ladies 110, for a total of 593 other than the ladies.

At this time I would like to introduce the members of the American Railway Bridge and Building Association Executive Committee seated at the head table. Each will stand when his name is called and remain standing until all have been introduced. Please withhold your applause until all are introduced.

Director, R. A. Tallent, Process Engineer Structures, Southern Railway, Atlanta, Georgia.

Director, D. R. Ladner, Assistant Chief Engineer, Chicago and North Western Transportation Company, Boone, Iowa.

Director, T. E. Kuhn, Engineer Special Projects, Missouri Pacific, St. Louis, Missouri.

Director, H. J. Laga, Assistant Environmental Engineer, Chicago & North Western Transportation Company, Chicago, Illinois.

Director, J. W. Davidson, Assistant Director, Bridge Engineering, Burlington Northern, Overland Park, Kansas.

Junior Vice President, D. A. Bessey, Assistant Chief Engineer—Structures, Milwaukee Road, Chicago, Illinois.

Junior Vice President, J. M. Williams, B & B Supervisor of the EJ&E, Gary, Indiana.

Senior Vice President, J. Budzileni, Senior Structural Designer, ICG Railroad, Chicago, Illinois.

The remaining two guests will be introduced later. You may now applaud. (Applause)

President Hernandez, would you like to make your introductions, please.

President Hernandez: Thank you, President Denz.

At this time I would like to introduce the members of the Executive Board of the Roadmasters Association. Starting at my extreme right, Mr. J. G. Wood, Director, Chief Engineer, Chicago Region, Burlington Northern, Chicago, Illinois.

Mr. K. R. Welch, Director, District Engineer, Missouri Pacific, North Little Rock, Arkansas.

Mr. C. M. Funk, Director, Engineer Track, Union Pacific, Omaha, Nebraska.

Mr. T. R. Rosamond, Director, Assistant Engineer Track, Seaboard System, Jacksonville, Florida.

Mr. J. T. Smith, Director, District Engineer, Union Pacific, San Francisco, California.

Mr. M. J. Marlow, Director, Supervising Engineer of Tracks and Property, EJ&E Railway, Joliet, Illinois.

Mr. M. B. Mitchell, Treasurer, Procedure and Joint Facility Engineer, Southern Railway, Atlanta, Georgia.

Mr. D. E. Staplin, Second Vice President, Director of Planning and Reporting, Seaboard System, Jacksonville, Florida.

Mr. H. V. Meek, First Vice President, General Roadmaster, D&RGW, Grand Junction, Colorado.

Before you applaud, as you noticed I skipped one man. I did this so that I could attract your attention. We are very proud of Mr. H. G. Webb. Effective September 1 he is

the new Chief Engineer of the Santa Fe Railway. (Applause)

I will turn the rostrum over to Mr. Denz.

President Denz: Thank you, President Hernandez.

Introduction of P. C. White

It is both an honor and a pleasure for me to introduce today's keynote speaker at this Joint Session of our Association's 88th Annual Meeting. I have had occasion to work with this gentlemen, Mr. Peter C. White, for close to twenty-five years, and he has always been the type of fellow employee you enjoy working with.

Peter White was born in Seattle, Washington November 30th, 1929 and received his Bachelor's Degree in Civil Engineering from the University of Washington and his Master's in Business Administration from Northwestern University. Mr. White joined The Milwaukee Road as an instrument man at Butte, Montana in 1953. He served with the U.S. Air Force between 1954 and 1956, returning to the railroad in 1956 as Assistant Engineer at Butte.

Following various engineering and operating department assignments at Deer Lodge, Montana, Savannah, Illinois, Milwaukee, Wisconsin and Marion, Iowa, he became Senior Cost Analyst with headquarters in Chicago in 1968. In 1969 he was appointed Manager of Market Research, becoming Assistant Vice President-Lumber and Paper Products in 1973, Vice President Corporate Services in 1976, Vice President Planning in 1978, and Vice President Marketing on March the 1st, 1980.

His directorships include the Washington, Idaho and Montana Railway Company, the Chicago, Terre Haute and Southeastern Railway Company, the Bedford Belt Railway Company, Trailer Train Company, American Rail Box Car Company, the Southern Indiana Railway Company, and the Milwaukee Motor Transportation Company. He is a Registered Professional Engineer, is the current President of the American Railway Development Association. A member of American Railway Engineering Association, Western Railway Club, National Freight Transportation Association, Transportation Research Forum, and a sustaining member of the American Society of Traffic and Transportation. He is very well qualified.

Mr. White, please. (Applause)

Update on Milwaukee Road

By Peter C. White

Vice President, Marketing

Peter C. White

Mr. White: Thank you, Omer, and after listening to all that, I also have to tell you I have to work once in a while also.

I hadn't heard before I got up on this platform this morning that Herb was going to be the Chief Engineer of the Santa Fe, so may I offer my personal congratulations, Herb, and wish you well in that job. I really don't think he has any problems. The Santa Fe is pretty well maintained. Right?

I welcome you to Chicago. As you heard, I grew up out West. I haven't lived there since 1953 but I always thought that the time somebody was going to send me to Chicago was the time I would go over the hill and go back home to the woods, but I have been there many times, and I haven't stayed, and I am still back here in Chicago. I have raised a family here. I am an empty-nester. My wife and I love that. It is a pretty great city and I

think you will have a good time here. Maybe some of you already have. I notice the ranks are a little thinner from yesterday, so there might be a few casualties.

I am up here this morning to give you a short talk on what I will call the sagas of The Milwaukee Railroad. You have all read about our trials and tribulations. It all started five years ago. I will accept some questions at the end as time allows.

I accepted your invitation to speak here this morning quite willingly. Typically, you would have a railroad president up here, and even more typically, he would be the president that is the President's boss. That is kind of a habit with lots of associations. But my boss, Mr. Smith, went off to Hilton Head, and he is spending two weeks there, and he doesn't let anything interrupt that. So you are stuck with me then, a vice president and a vice president marketing at that.

I would guess that most of you don't have much association with vice presidents marketing, and I am sure you are wondering what a marketing V.P. can impart to a gathering of maintenance types in a mere half hour or so. Actually, you will have to wait and see, but first I must say that my job usually requires talks after luncheons, outings, and dinners. They are fraught with sleepy guests and an occasional soul who doesn't even agree with me. It now being after breakfast, I can see an alert and ready audience. You are all sitting in the back, though, so I can't get really too good a view. You are all bright-eyed and bushy-tailed, and I don't think any of you left the Hyatt last night and went to Rush Street, so I expect an attentive audience.

Now having established all of your qualifications as an audience, I will spend a minute establishing mine. Omer's introduction did hit some of the high spots, but I will disdain modesty and embellish that somewhat.

In order, I am a Civil Engineer by education and training and registration. I haven't done much of that for twenty years. I have actually built some bridges, though, and some buildings, and some line changes. No B & B supervisor ever accused me of setting pile cutoffs wrong, and if he did he knew how to fix it. There are ways, I understand. I will even date myself by stating that with a little review I could stringline a curve; by hand, that is. I think it is a lost art today. The modern machines have really antiquated that old and staid system. I even spent three years as chairman of AREA Committee 14, Yards and Terminals, and I haven't had an opportunity to harangue maintenance people since those days.

All of those things I did for ten years before making the big league, to the operating business. I must say it was like going to a foreign land to leave the orderly and measured engineering profession, to take up trainmastering and assistant superintendency. As you can see, I survived despite the hours, weekends, and holidays required. I suppose those tests were needed, because more trying times were ahead.

I won't dwell on the reasons for The Milwaukee resorting to bankruptcy for the third time in this century. Suffice it to say that we had too much physical plant and too little business. With inadequate income, the result was ordained. Things became run down to the point where performance became all but impossible.

Maintenance Program Planned

I can recall the winter of 1978 when 50 per cent of our power was out of service for a time, and most of our track was severely slow ordered. '78 was a severe Winter. A few of us survivors reasoned that we had to swiftly reduce the plant and concentrate on our midwestern strengths. We have done that, although not as swiftly as we would have desired.

There was formidable opposition to our plans, but today we stand with about 3,100 miles of railroad in the Midwest out of 10,000 miles of transcontinental railroad five years ago. Employee counts have been reduced to about 4,500 during the process. It looks like our operations during 1983 will generate a modest profit.

I have been with The Milwaukee since 1953, thirty years less some Air Force service. This is the first time in my career that we have been able to plan and stick to it. It is true that some flexibility is required to ride the ups and downs of economic times, especially in the last two years, but overall our programs for maintenance are being carried out as planned. A five year program

has been designed and is calculated to aid and abet our marketing in strategic directions.

I emphasize that our maintenance plans were not concluded in a vacuum. We do not over-maintain, and soon will be eliminating all deferred maintenance. Nate Smith, our Chief Engineer, has stated to the press recently that all main line trackage will be at the long run required marketing utility level by 1987. Considering from where we started, that is and continues to be a major accomplishment for Nate and his people, but, despite that, those are heady words to emanate from an engineering department. You would think it was something I would have said.

Well, marketing utility level may sound mysterious, but to me it means that we have defined what is required in markets insofar as train speeds and service are concerned and have articulated that through a comprehensive program of track maintenance and rehabilitation. Put a little more simply it means that my people, the marketing types, must justify from a business standpoint what is spent and where it is spent.

Now we started rehabilitating things in early 1977 with 4-R program work. The first one was small, but they grew through '78, '79 and '80. The 4-R work was concentrated on Chicago to St. Paul on the double mains. During that time we had to make analyses and decisions on whether to keep one main or two mains. We decided to keep two mains, not because of tonnage considerations but because of train service considerations.

We found that if you made a typical analysis using tonnage as a criterion we really didn't need two mains, but when we got into the analyses on trains, train interruptions, train takeovers, (we run three sprint trains in each direction, we handle Amtrak and all of our other freight service) we reasoned that we needed two mains. We have them and will continue to have them. We regard that as a big asset today.

In other areas like our Mason City line which is in the corn country, Northern Iowa, we carried out programs with state and shipper help. That line is pretty well rehabilitated today and is in good shape. We did some work on our own in the Wisconsin valley, and had a little 4-R help up there. On the northern end we did a shipper thing. We have scratched, and we have saved, and we think we have a railroad that serves its customers today.

Now I don't make it a habit to give talks on exactly how The Milwaukee has been able to survive and come back. You have to realize we are in a brutally competitive business, and I don't think it prudent to enable competitors to understand our management style. I would prefer to let the results demonstrate our success. I believe that is sufficient.

Our 1983 plans include 150 miles of new or relay welded rail. We have taken up a lot of railroad, so we have a lot of rail to use. Our program includes 310,000 new crossties, 305 miles of surfacing with varying amounts of new ballast, and 500 miles of surface correction. Now that isn't a lot for some of you larger entities, but for us it is significant.

Obviously, it would have been impossible without some cash flow from operations. Also, it doesn't take a genius to conclude that marketing plans must be working in order to develop the earnings in the first place. This we have done.

We stand on the threshold of change at this point. Future change for the Milwaukee is evident in two major areas. Firstly there is deregulation in all of its ramifications, and secondly is mergers.

I will go so far as to say that deregulation in the area of ratemaking has been instrumental in allowing The Milwaukee to do what was required of it. We have been able to put together marketing programs and deliver to customers benefits that would have been impossible under pre-Staggers Act regulatory constraints.

Notice I said "deliver." My people can be as innovative as Houdini, get out of all kinds of traps, but unless we deliver I will guarantee you shippers will go elsewhere. Instrumental in being able to deliver is predictability of service. Maintenance and rehab have been major elements in our success. We have actually gotten large segments of new business by boldly telling the shipper to try us, and if we fail in any way we would expect you to go elsewhere. They stay because we produce with price, equipment, and consistent service.

Deregulation

Deregulation is having major effects in other ways on the transportation business,

that you folks should be aware of. The trucking industry had a head start on deregulation. They were a year or so ahead of the rails. Enterprising trucking companies have moved aggressively to take advantage of their freedoms, of increased loads and truck size. Owner-operators, a major element in transportation when considered as a whole, have been more aggressive in recent times. Their prices generally reflect a tenacious ability to hustle. They are one-man businesses, and I will tell you they do hustle, and they survive in tough times. They are not to be discounted.

This has an impact on the intermodal business in all of its ramifications. Intermodal is the growth business of the railroads today. You can't point out to me any piece of our business that is growing faster. The Milwaukee's intermodal unit volume has more than doubled as a per cent of total unit volume in the past year and a half. We are over 30 percent above our forecasted volume in recent months. Our physical facilities for intermodal are being taxed for the first time ever, even more than when our railroad was three times larger and we had all that intermodal business to the Coast. I have to tell you that from a facilities standpoint and from the service aspect, intermodal has to be run as truck-competitive in all respects, price, service and time, or you can forget it. All of which means that railroads must be maintained well to compete well.

Another aspect of deregulation that will affect us all is the boxcar business. You know, while all sorts of pundits proclaim that the boxcar is dead I tend to believe that it will find some degree of reincarnation for a time. It is our belief that boxcar deregulation will go into effect as scheduled. We are conducting our plans to accommodate that, November 7th, 1983.

Here again we have another element of change to be managed, as if we didn't have enough in these days. While maintenance of way departments don't get too excited about boxcars, you can be assured that you will get excited if money isn't available because of losing all of your boxcar business. For the Milwaukee, boxcars handle 28 per cent of our business today, so you can see it is not a small element. On other railroads I would judge it may be even higher than that. By any measure it is not insignificant, and shifting shipper preferences could cause huge problems for those carriers that do not adapt to the changes taking place.

Mergers

The other big arena that makes us all wonder is mergers. Now, many of you have been involved in large mergers in recent past years, UP-MP and Western Pacific, the NWS, Chessie, BN with all its ramifications clear to Frisco. As a marketing guy, you couple those big mergers with the freedoms of deregulation, and they give me problems. I mean they give me big problems that must be coped with.

Now, in the merger business we feel that, well, maybe four or five years ago everybody in the railroad trade had the Milwaukee all but dead and buried. But having passed through the valley of the shadow of death, so to speak, I can say that it does feel better to be wanted by someone. The process of trimming down and shaping up, as the headline of a *Railway Age* article recently put it, has made The Milwaukee a desirable bride. We have an agreement with the Grand Trunk Western for coordinated service that is working well. Hearings have been concluded at the ICC on their purchase offer. Those were concluded about two weeks ago. The Chicago & North Western has made a competing offer which is currently being evaluated. Hearings on that offer start in Washington on December 12th.

Indications are that the Soo Line is considering stepping forward with an offer of their own. I don't know what they did yesterday in court. Rumor mills also produce the intelligence that if the Soo Line moves someone else may enter the fray. We find it all very interesting. Not surprising, though, we have always felt that the ultimate solution to our case would be inclusion in a larger system.

Summary

It is especially gratifying to reflect upon the crucial decisions made some years ago that are actually paying off today. The decisions are simple ones, really. We got out of markets where we couldn't compete well and concentrated on those that had potential. So far we are correct in our concentra-

tions. Marketing programs coordinated with maintenance of way and train operation have paid dividends. Admittedly priorities were difficult in the early going because funds were scarce. Track and locomotive power, in my estimation, shared the Number One category. That is where the bulk of our available funds went. It was well spent. We run lots of trains today with single units, and the only way you can do that is if those units are well maintained.

We feel that the public interest is being well-served, employees are being fairly treated, even those no longer with us of necessity, and that creditor interests are well served.

I can recall the day shortly after bankruptcy about five years ago when our holding company stock traded for 2-7/8ths for a time. That is two and seven-eighths dollars. Yesterday it traded at 97. It has been as high as 104 or 105, I believe. That is progress by any ultimate measure. It was made possible by well coordinated programs of marketing and maintenance.

This is not to say that other elements of the equation were not required for success. We have been blessed with two excellent trustees, legal and financial decisions were well conceived and well executed, the 4-R act was fortuitously timed, employees sacrificed pay, labor leadership proved to be flexible and cooperative. In closing let me state that I in my capacity as a chief traffic officer have nothing to sell without dependable service. You folks are the foundation of that. Without it, my people in marketing can't deal in confidence with those customers who pay the freight bills. Without confidence derived from performance, selling becomes impossible. I know that vicious circles can result from such problems. You can prevent them by being ever cognizant of the fact that customers pay the way. Take care of them first and you will reap the benefits.

Now if anybody has any questions, I would be more than happy to answer them. If they are too sticky I won't answer them; I'll defer to the lawyers.

No questions, Omer. You will have to carry on.

President Denz: There must be some questions out there. Has anybody got a question?

You must have covered the subject really well. Thank you, Mr. White, for your very enlightening and timely address. We are aware of your heavy work schedule on The Milwaukee Road and though we would appreciate your staying with us, please feel free to leave at your convenience. I know, however, that the next special feature will be of great interest to you. Thank you, Mr. White. (Applause)

President Hernandez.

President Hernandez: Thank you. President Denz. At this time I would like to call upon our Program Chairman, Mr. Mike Marlow, to introduce the next featured speaker.

Mr. Marlow: Thank you, Mr. Hernandez.

I think we are all aware of the problems that the Denver & Rio Grande Western had this past year with landslides at Thistle, Utah. Our First Vice President, Huburt Meek, is General Roadmaster with the Denver & Rio Grande and has been very much involved with the problem out there. Mr. Meek is going to give us a blow by blow description as to all the problems and solutions that they have come up with. Huburt.

President Hernandez: At this time I would like to release the Board from the head table so that they can see the slides. This is a very current presentation. Mr. Meek.

Thistle Landslide and Track Relocation

By H. V. Meek

General Roadmaster, Denver & Rio Grande Western R. R.

Mr. Meek: Ladies and gentlemen, most of you probably remember the comic strip, Li'l Abner and Joe Bfsplk. This spring we hired as geotechnical consultants a Joe Bfsplk firm, Shannon & Wilson. When we hired them we immediately received a big cloud over us, and the moisture just kept coming down, and all of a sudden the landscape started moving. The President one day said, "You know, we didn't have a damn bit of trouble until we hired them." But, anyway, this presentation is about our problem at Thistle, Utah. I will try to follow each area from start to finish, so that you can see how it progressed. At one time we had over 750 men and 400 machines employed in a six mile stretch.

Now if I could have the lights down and the slides on, please. (Whereupon, there was a slide presentation with the accompanying remarks.)

H. V. Meek

On April 12, 1983, Dave Hilts, Vice President of Shannon & Wilson, and I met at Thistle, Utah, to check where some mud was over the siding.

This had occurred every spring for years and actually was, as it was determined later, the location of an ancestral landslide which at some time in the far distant past had come down, and from the indications it reached about the same height as the slide did this year. The water this time would have been that same height if we hadn't put in a diversion tunnel.

We could just find a few local spalling cracks that you can see right there on the cut. We walked up the hill about a quarter of a mile, but did not find any evidence of any cracks or anything sliding on the 12th of April.

Here is the westbound main track with CWR strung out alongside for re-lay, then the eastbound track, and over at the far left is the siding. To the right of the track is the Spanish Fork River, and the cliff that you see is a portion of Billie's Mountain which served as a natural buttress for the slide. This shows the mud on the siding.

This was the way the siding looked two days later. On April 13th it started moving, heaving up and out of line. At that time there was little indication we were about to experience a massive landslide with eighty to ninety million cubic yards on the move.

By daylight the 14th there was no doubt we were in for trouble but not then to the extent that later developed. We kept the trains moving by continually unloading ballast and raising to the high spots.

By this time we had given up on the eastward track and siding, of course, and were just maintaining the westward track.

During the day of the 14th we kept it in service, and by nightfall the track had heaved as much as nine feet in places, and had gone out of line over fifteen feet despite the fact that we had continually been lining it back all day.

This is taken out of the locomotive as we were proceeding with one of the many trains that day, a picture of a coal train; you can see the water now coming up between the two tracks. This was a rotational type slide, and it was not only heaving the track, it was also heaving the river and the highway. We put in a dike thinking that we could hold the water back and maintain it.

The last train over the old line was our westbound Rio Grande Zephyr at 8:20 P.M. April the 14th. Normal service was restored at 3:00 P.M. July the 4th, which was the 81st day.

During this time we constructed 6.1 miles of double track grade with a service road alongside except for the 3,015 foot railroad tunnel, 11.2 miles of track laid with 12 inches of ballast under the ties, two 10-car setout tracks, seven switches, the 3,015 foot railroad tunnel, the 476 foot water diversion tunnel, 540 feet of 12-foot CMP connected to the diversion tunnel encased in 3,000 cubic yards of concrete, and two twin 12 foot by 12 foot concrete boxes 150 feet long to carry Diamond Fork Creek into the Spanish Fork River.

This was Thistle, Utah, the morning of the 15th, the first morning we were out of service.

And here it is just a little later, that same CTC booth. We have it picked up waiting for a train to shove a flatcar under it, so we can get it out of there.

This is the section headquarters the morning of the 15th, then the same building that afternoon with water almost to the roof. This is a picture looking down the slide. It was a rotational slide which resembled a glacier, as you can see. It was a little over one and a quarter miles long, 1,200 feet wide, with 1,600 feet difference in elevation from the toe to the top.

This is a picture taken from across the other way looking up the slide. We were still hoping that the thing would stop and we could move enough dirt out of there to get our railroad back in business.

This slide buried the railroad, destroyed Highways U.S. 6 and 89, and flooded the town of Thistle. Now in these pictures you will see the dates in the lower right hand corner.

This is the highway on the 14th.

The 15th in the A.M.

The 15th in the afternoon, out of service.

There it is the next morning.

This is an aerial view of it.

This is the same day, and you can see we are still trying to keep that damn river open.

This is the same highway on the 17th. Our track which was over on the right hand side of the picture three days before is now 40 feet in the air up against the cliff. That gives you an idea of how that thing moved. On the 16th the slide moved horizontally 54 feet in a little over twelve hours.

The slide formed an earthen dam 220 feet high by the time it was through. This is just one week after this slide started. The dam ended up 220 feet high, 900 feet wide and 1,500 feet thick at the base. It created a three mile long lake over 200 feet deep at its peak, holding over 80,000 acre feet of water.

This is another picture with the railroad over to the right. The streambed is dry except for the water that is coming down to the right hand side of the slide. There is no water coming through the dam.

The decision to make a new double track line north of the Spanish Fork River out of the slide area through a 3100 foot tunnel was arrived at on April 21st. Five days later we were drilling the 475 foot water diversion tunnel. This is the upstream end of it, and that is the downstream end.

The diversion tunnel was to keep the lake from overflowing, which it had done in that ancestral slide time, as it would have destroyed the dam along with the consequence of severe flooding and destruction not only of the railroad and highway downstream but also the town of Spanish Fork.

This tunnel was completed in seven days and a shelf blasted out of the cliff on the downstream side where 540 feet of 12 foot pipe were placed with the large concrete cover over the pipe in the slide area to protect it, so if the slide did come up it would not collapse the pipe. Then around each joint was a cement collar- and, on the far end, a heavy thrust block.

This was completed on the 17th of May. Shannon and Wilson had figured that the water would start through the diversion tunnel on the 19th, when we first started the tunnel, and they missed it by one day. It started in on the 18th. It was originally figured that this pipe could carry about 1,200 cubic feet per second with a 10-foot surcharge, but fortunately the engineers in all the changing of benchmarks fouled up, and the upstream side of the tunnel was ten feet higher than it was supposed to be. It was holed through with time enough to dig the floor down to the original desired elevation; so, therefore, it had a funnel effect and was able to handle 2,000 cubic feet per second through this pipe at the peak runoff.

On May the 31st, the inflow into the lake reached a record high of 2,800 second feet compared to a previous record of 1,800 cubic feet per second in 1952. The lake rose to an altitude of 5,204 1/2 feet above sea level or 204 feet above the old streambed.

By the way, there was one contractor who bet that there would never be over four foot of water through that pipe so he hedged his bet, and when he got to the four on the indicator he just continued with the 4's all the way up. (Laughter) That is our General Manager standing there.

This is a picture of the upstream side on May 6th. You can see some of the housetops down there. It was thought at one time these were just the roofs of the houses from Thistle, but it turned out that it floated the entire houses off their foundations. Those houses had floated up and down all over the lake. They were finally secured at one end so that they wouldn't plug the diversion tunnel.

This is an act in futility by the Corps of Engineers. They decided they would bring in the barges and pump the lake out. (Laughter) They finally did get about 200 cubic feet per second going through the pipes and proved the fact that they didn't need to be involved in anything else. They did have quite a unique deal. These are 24 inch welded rubber pipes. They ended up with five pumps out on the barge pumping into a mixing bowl up on top and then discharged down the other side, as you can see.

This is the 18th. They were pumping water, and the water was just starting out of the diversion tunnel.

This is a picture of our president on the day that the water was at the highest in the lake. He is wondering "What the hell happened to my railroad?"

This is a view of the discharge, the dam, the old railroad down here on the right, and here, bottom center, is a new tunnel that the State is drilling about 2,100 feet long that is going to tap the lake. They figure on draining it and then will decide after that what they are going to do with it. Our railroad tunnel is at left center.

This is a water supply that was five miles down from the dam. The water was pumped around the corner to a wide spot in the highway where our batch plant was set up. As much as 2,500 cubic yards of concrete a day came out of this plant.

This is a picture of Billie's Mountain and the access road over the top. Some of it was about a 36 or 37 percent grade, and if you ever want a thrill you ought to be trying to go up that in a four wheel vehicle, and here comes a D-9 Cat with the brakes set sliding right down the hill at you. (Laughter)

The black material you see is some of our ballast that was hauled up trying to make an all-weather road, but it rained and snowed and rained and snowed to the extent that we ended up with about a 4-foot trough. Every once in a while a dozer would go up and scoop all the mud out so the four wheelers could get over it again.

On April the 27th drilling started on the railroad tunnel through Billie's Mountain from both sides. Both the tunnel and the grading work were put on around-the-clock seven-day-a-week operations.

The construction contractors were Morrison-Knudsen for the tunnel on the east grade. Lowdermilk was the prime contractor on the west side, and he also handled the concrete work and is presently handling the concrete work for the two tunnels. Consulting geologists were Shannon & Wilson, and actually they are good people. Our engineers were Intermountain Technical Service from Grand Junction. At one time we had fifteen survey crews on the job.

Shannon & Wilson geologists crawled all over Billie's Mountain for four days and gave a very accurate description of what we would encounter in the tunnel.

Right in this location we removed these twin bridges, put the river through the old abutment, filled this up, and ran the railroad through here.

The State Highway Department in Utah

gave us very good cooperation, and were very instrumental in getting a big three-stage jumbo drill from New Hampshire. Ordinarily it would take a minimum of three weeks to transport it across the country. It was moved across in four days, including over a weekend, as high wide loads. The State Patrol in Utah got permission for us to move across all the states from New Hampshire, with State Patrols as escorts.

This is a picture showing Diamond Fork coming down from the left into Spanish Fork. We came across alongside this hill here. That is where we ended up going in with our tunnel. Out original grade was over to the right.

This cut right here is called the Big D Cut because right here is the Big D Restaurant. This was a berm that we put up in the middle of the highway to keep the rocks from rolling down into the restaurant. The cut ended up 289 feet deep and 1,500 feet long, all solid rock.

This is a picture of the same cut a little later on. This is the barrier for the Big D, and you can see the grade being completed up here.

Here is a shot being set off in the Big D cut. The scrapers all lined up ready to move in. They didn't wait until the dust settled; just until the rocks quit falling.

This is another cut called the Rio Grande Cut. It was right above our office.

There were eight drills drilling at one time here.

Here are two D-9 Cats doubleheading a scraper, loading it up.

Here is a view of the west end of our eastbound tunnel. The westbound tunnel was punched through here August 24th. The concrete lining in it will be completed about the 10th to 13th of October.

This is the old railroad roadbed over here, and of course this is that damn dam, and here is the location for a switch. There is single track for about a mile through the mountain, with a number 20 turnout on each end to go back to double track.

This is a picture of Diamond Fork on May 17th showing a 245 backhoe loading mud into a 50-ton truck. About ten feet of mud was excavated, fabric placed, filled with rock, then select material all compacted, with fabric on top, then the two twin 12-foot × 12-foot × 150-foot concrete boxes. This shows where the slop was dumped over the side of fill. Notice the angle of repose is 2 to 3 degrees.

You B&B men will be interested in the time frame for these boxes. This is May 20 showing forms being placed; 21st reinforcing steel; over 270 tons were used. The 25th, top form is being placed. June 4th, boxes have forms removed, only twelve days after excavation started. We had a bunch of good carpenters and steel men with round the clock shifts. June 6th parapet walls are in place. June 14th water flows through boxes and the fill is well on the way to its 35 foot cover. The concrete was up to 4000 strength in five days. 3000 cubic yards of concrete were placed in these boxes.

Here is a cut just west of Diamond Fork which gave us a lot of trouble. It looked OK on the surface, but when the cut was made we found rocks bedded wrong and sliding down. We later moved the line out 50 feet.

Now the slide that you can see here opened up as we were going along, and it was recommended that we put a 4 to 1 slope. All of our design was a 1 to 1 slope in all dirt with a 57-foot wide roadbed, so we would have an access road and room for a ditch. We put in the 4 to 1 slope, and one night at dark it looked beautiful.

That's the way it looked the next morning. We then decided to move it out 50 feet and get away from both problems. This delayed us about a week, but we were still able to get through before the construction of the tunnel.

This is a view of the fabric that was installed through this wet area. You can see this slide now on the 4 to 1 slope, and we are moving out from where we had originally planned.

This is the same location taken on the 23rd of June. The machines are coming right on down with laying the track.

You can see the trucks lined up here with the new panels. When the contractors would give us a stretch we immediately went in and would fill it up. If they gave us a half mile of grade overnight the next evening we had a half mile of track laid there, and waiting for them to do some more.

On the east end one day they gave us a pretty good stretch and the gang in eight hours laid 90 panels of track. This was all new 136 pound thirty-nine foot rail. We con-

structed the panels in Grand Junction and used a Burro Crane to lay them. We trucked all of those for the west side around by highway, and the ones for the east side were brought over in gondolas and then trucked out onto the grade.

We rolled the Burro up on this flatbed. It is a goose-neck machine which made it easy to load and unload. We put a short panel on and loaded the Burro.

We moved it up close to the tunnel and then started laying track. Here he is unloading the Burro. He is setting his own panel, so he can get off the truck onto the track.

This is where we put the Burro to work up here, just west of the tunnel. We put as much single track as we could up around this curve, but we had to stay away from the tunnel construction so we could only get about thirty panels above the Number 20 turnout then double track on down the country.

This is a view of the Big D Cut with the track in the 22nd of June.

This is the Loram sled. We are moving right along, 15 miles an hour. That's the way to surface track. We did this on the one track on the east side and then moved the sled over to hurry up and get this one, and it worked very successfully.

This is that same afternoon. The work train has backed in, dumping ballast for the next run.

One night at 2:00 A.M., our track patrolman found that the river had moved in about 50 feet in a short time. Fortunately we have a lot of equipment. I don't have any idea how many thousands of yards of rock we put in on about a 20 mile stretch, because the river came up higher than at any time in recorded history, and we had washouts all over. These 50-ton rock trucks are ideal for hauling big rock.

This is the typical view of a number of bridges on the Marysvale Branch which goes south from Thistle. Thistle Creek wanders back and forth underneath the track. We had about eight bridges that looked like that. We had all kinds of washouts that looked like that.

We were flying a shortcut from looking at the Marysvale Branch over to the east side. There are about a hundred head of elk down below us.

This is just a little diversion over at Salt Lake City. Most of you have probably seen the problems on TV that they had in Salt Lake City—running water down the street. That is a dike over two of our passenger mains to hold the water and to force it through the culverts we have. This is the water running down the street, and this happened to be at the low water time, but if you will notice, they have a unique deal. They just pile up sand and throw plastic over it and then sandbag it top and bottom to hold it. They took some of the main thoroughfares and made rivers out of them through Salt Lake City.

This is over on the North end of Salt Lake where we go alongside the UP yard. The city cut all of their tracks except three. This is a bunch of 8-inch plastic pipe that we put between each tie crib to help get the water through so it wouldn't keep scouring us out.

This is a picture of Mount Timpanogos in Provo on May 7th, just to show you how much snow was there. Just to the north of there at a ski resort they had 804 inches of snow last winter, just to give you an idea of how much moisture is in that area.

This is the same mountain about a month later. You can see the snow receding, and things are looking much better.

This is the east end of the railroad tunnel just getting started, and the new grade will come through here. Notice this white house on April 28. The elevation of the eaves on that house is 5,204 1/2 feet because that is where the water came to. The railroad went just above that, fortunately.

This is a picture of the house on May 25th. The first of June water was up to the eaves.

This is the east end of the job May 7th with track removed to a point where new grade would start; the same location ten days later.

Another view of the same spot May 25th. Now you can see the houses floating around. This is looking towards the east end of the job.

Laying track east end on the 6th of June. These are the new panels I was telling you about. We unload like this out on the grade.

This shows the same location the next day with the work train full of panels shoved down. The next day we had the train about three-quarters of a mile farther because they gave us a lot of track that day.

6-05-83

6-13-83

This is a picture about a mile from the east end. This is view of the lake east of the tunnel; notice the roof tops. You can see where we are coming along with the grade. Interestingly enough, we had five major geological formations in this whole area. There was old rock and new rock. I didn't know there was such a thing, but some of the rock in the tunnel was fifty million years old and some two hundred and fifty million years old.

This is along that long, straight stretch of track. By the way, we ended up with a maximum 4 degree curve, where the old line had a 7-1/2 degree curve, and a 2 percent compensated grade for a ruling grade. The track along here ended up level.

Here it is on the 13th. Our switch east of the tunnel is right about this location. This is that house again and the work train on the 14th of June.

This is the steel gang laying the second track using CWR. The first track was laid with panels. The ties were pre-plated at Grand Junction for every fourth tie. When all ties were distributed, CWR was laid, then we used the tie gang type spikers to spike up, and made very good progress with this.

This is where we are slipping the jointed rail, so we would not have square joints. We staggered the rail from 6 to 12 feet.

This is a picture of just a portion of the panels that were removed from the old track.

A view of the west end of the tunnel portal, and here it is a few days later.

We figured on a 3,100 foot tunnel but knocked off 60 feet of the west end trying to get turned under. The sandstone was so soft that the normal drilling methods were not working, so they got what is called a Roadheader. This head revolves and chews right through soft sandstone, puts it down, and it is picked up on this conveyor tray, and dumped back behind onto a conveyor belt, and then the loader picks it up.

This is a view at the east end of the tunnel, scaling down to where the tunnel starts.

To get turned under here they cut off about 40 feet. They have come straight down with the drilling and blasting and now have reinforcing rods drilled in, and heavy Gunite coating over it so nothing would spall down.

This is an interior view. This one happens to be our westward tunnel, by the way, but you can see this ventilation pipe at the top. That created a little problem for us later on while laying track. On the first tunnel the steel sets were on 6-foot spacing, and you can see the lagging that is placed in behind. On this tunnel we went to 7-foot spacing because we were able to concrete this before any trains were run through.

Here they are concreting the base where they clean out real well and go clear back to the wall with the concrete and six inches inside of the steel sets.

This is a picture of the jumbo drill at the face of the tunnel.

Here is a picture of one of the jumbo drills outside. As you can see, it is a three-stage outfit; they can run twelve air drills all at one time.

There were fifteen or sixteen delays on the shots. They would shoot the center ones and then the others would go in rotation. This is the helicopter stringing communication and signal cable over Billie's Mountain from reels on the truck.

This is some of the different formations that were in the tunnel. I don't know if you can read that or not. This is what Shannon & Wilson worked up for us, and, as I said, they turned out to be very accurate, and they did this in just four days of crawling over that mountain. They didn't have any chance to drill any test holes or anything. They even forecast that we could run into a cave inside, and sure enough, there at one location, we did run into a cave inside the mountain where the water had leached out through some of this material.

These are the formations over the entire job and, as I said, there were five, and I think he has got seven of them listed there, but there were five major geological formations with a lot of breakdown of different formations just in this six miles. A geologist can go out there and have a field day.

This is a view of our panel yard in Grand Junction where we use the Burro Crane. We use an automatic spiker, an anchor machine, and we have a tie handler to place the ties and the whole jazz. With ten men they were turning out 40 panels in an eight hour shift.

This is where they were practicing to lay through the tunnel. I showed you this overhead pipe. Now you see all the counterbalance we put on the back of the Burro because we had to lower the boom down to

22 1/2 feet and carry the panels into the tunnel with the Burros. A Speed Swing was put ahead so that when the Burro laid and hooked the one rail together he would run back to get another panel, and the Speed Swing would then line the track and drive the other rail back if it needed it.

This is a view of the switch east of the tunnel, the west end of the double tracks there, and then into the tunnel.

Now laying track in the tunnel: you can see the Speed Swing is lining the track. The surveyors, ahead of time, marked every 39 feet how far it was out to the gauge corner of the low rail, and that way we would line each end of the rail.

Here with the Speed Swing they are bumping the rail back on the high side. One man is pulling the spikes so he can put the angle bars on when the Burro gets back with the next section.

To save a lot of driving we cut 6-inch dutchmen, and when we got six inches of gap on the high side we would throw in a dutchman. The first twenty four hours we operated over this, and then the next day, after we got a little slack in between trains, we went in and pulled the rail and took the dutchmen out.

This is a picture of our Division Engineer from Denver who was the project manager on the job, and in fact since the first of September he is now our Chief Engineer after Mr. Waring retired. Mr. Chuck Burroughs.

This is just a view of the track in the tunnel, and some of you might wonder what the braces are for. We had a grade break coming into the tunnel so we didn't want to take any chances and put these rail braces on this 4 degree curve. Usually we don't put them on until we have an 8 degree curve.

This is a picture where we have the ballast train coming in from the west end while the east end is just getting ready to finish laying panels. The reason Speed Swings were used was because it was the best way of getting the machinery out that was on the ground without knocking all the ties down. He is now moving up onto the track to put his wheels down and hy-rail out of there after he gets the last panel in.

Here we are measuring for the last panel in the tunnel. We laid from both ends. Of course, we had to leave room on each end for operation of the tunnel people, but in a twelve-hour period we laid 4,000 foot of track in this tunnel, dumped the ballast, surfaced it, and had trains running.

Here they are sawing the rail, so that when the panel comes in it will fit right in place. This is the last panel being placed.

There is a tamper getting ready to go in the tunnel.

Here is the first eastbound train and the Big D Cut in the background.

The first westbound train—we had ten trains sitting there waiting to go through the tunnel besides the other ones that were in the yards.

This is a picture of the east end of the tunnel with a train coming out. This is the steel sets for the barrel on the westward tunnel. There will be a 50-foot barrel on each tunnel to keep snow and rock from sliding down off the hill and giving us problems.

This is a picture of the switch west of the tunnel. This is as it looks today with the dam in the background.

Here is a picture east of the tunnel showing the train going along.

The elevation on the old track at Milepost 681, which is under the dam, was 5,010 feet. The west portal of the tunnel is now 5,150 or 140 feet higher than that, and the east portal is 60 feet higher yet at an elevation of 5,210. Then we level out nine feet higher on a vertical curve, go for three-quarters of a mile, and then go down to 5,210 again.

The lake ended up giving us a freeboard of only 5 1/2 feet at one time.

Now you see all these pictures showing the two tracks not quite meeting, where one rail meets but it is the south rail meeting the north rail? Well, there was a lot of wondering after the mistake on the diversion tunnel how well they were doing on the railroad one, so they were constantly checking. When the tunnel was bored through the line was off one-half inch, the grade was off an inch and a quarter, and they had missed the calculation of the length by three inches.

We have a new slogan to give to our customers now, "We move mountains to move your business." That, folks, is the end. I hope you enjoyed that. We can have the lights up now, please. (Applause)

Does anybody have any questions? I hope not. Well, that concludes this program for you, Mr. Hernandez.

Mr. Marlow: Thank you, Huburt. It seems like the Rio Grande always does things in a big way.

Mr. Hernandez.

President Hernandez: Thank you very much, Mr. Marlow and Mr. Meek.

I would like now to turn the rostrum over to President Denz.

President Denz: Next on our program we have a special feature which will be introduced by Director R. A. Tallent. Mr. Tallent, please.

Mr. Tallent: Good morning, gentlemen. As you know, the B & B and the Roadmasters Associations are constantly looking for new equipment, new ways to improve our jobs and make it easier. This morning we have a presentation from Climbing Hoe of America on the Menzi Muck machine which I think you will find very interesting.

Mr. Harry Vaughn, who is Vice President of Sales for the Southeastern Region for Climbing Hoe of America, has been in the equipment industry for some twenty years working in sales, parts and service, and various other departments. He has worked closely with customers and salesmen in applying unique capabilities of this machine to other jobs and job requirements. Harry had a broad experience with a number of different industries, including the railroads. Mr. Harry Vaughn.

Harry Vaughn, Climbing Hoe of America

Mr. Vaughn: Thank you, Ray. Good morning, ladies and gentlemen. I would like to take this time to thank Ray Tallent and the other Board Members of the B & B Association for inviting me to be the guest speaker representing Climbing Hoe out of Fayetteville, Georgia.

After listening to all the problems that you people have in the last day and a half, I think we can take some orders back with us. You people have really got some maintenance problems in the railway industry, both in the maintenance of your trestles, your bridges, and your rail maintenance alone. This machine is probably the most amazing piece of equipment that has ever been introduced to the construction machinery industry. It is built by a firm called Ernst Menzi, Limited in the little town of Widmau, Switzerland.

Menzie Muck Climbing Hoe

By Harry Vaughn

Vice President, Sales, Southeastern Region
Climbing Hoe of America

The purpose of my presentation is to introduce you to the MENZI MUCK Climbing Hoe and how it applies to the railway industry. The machine is manufactured by Ernst Menzi AG of Widnau, Switzerland. The company was begun in the 1930's by Mr. Ernst Menzi who took existing pieces of construction equipment and adapted them for the severe working conditions of Europe. In 1966, Mr. Menzi developed the machine we see today commonly known as the MENZI MUCK Climbing Hoe.

Menzi Muck

Machine Description

The model we will be talking about is the Climbing Hoe 5000 T-2; it has 17 feet 3 inches of dig depth and 25 feet of reach. From the turntable up it resembles a hydraulic track excavator; in that the boom, when offset to the left, gives the operator maximum visibility of the bucket. The machine is equipped with a hydraulic, telescopic, extendable dipper which travels a full 6 feet 7 inches. It has 360 degrees of continuous rotation and averages seven rotations per minute. The two stabilizers in the front and two tires in the rear, below the turntable, make this machine unique. They are hydraulically operated from within the cab either vertically or horizontally, the concept being that they conform to the different types of working conditions and terrains in which the operator may be involved. The standard machine can climb a 60-65 degree slope, operate 360 degrees continuously on a 55 degree slope and level-up to dig flat bottom on a 45 degree slope. By putting the stabilizers and tires down and elevating the machine, it can work in a combination of 6 feet of mud and water. The cab is designed for operator comfort and maximum safety. It is critical that the operator have full 360 degrees visibility, at all times, to the four stability points: the two stabilizers and two tires. The cab is certified ROPS and with a simple addition to the roof, certified FOPS. Plexiglass is used throughout the cab in lieu of glass.

The first thing the operator will see upon entering the machine is the sight glass diesel fuel indicator. Fuel consumption averages 1-1/3 gallons/hour. The operator's seat is an air ride type with headrest, armrest, and safety belt. A pull start is used to start the engine. Conveniently located on the side of the cab is the throttle control which also acts as a shutoff.

Operation

To operate the backhoe, a four lever control design is used strictly for safety, one lever controls one function. A foot control on the floor operates two quick connects located at the end of the dipper. These are used when installing attachments such as mowers, demolition tools, augurs, or any other type of attachment for which we can provide the required P.S.I. and flow. The toe/heel control activates the extendable dipper. To operate the stabilizers in the vertical or horizontal positions there are two levers on each side of the seat. These levers are set for vertical movement of the stabilizers and tires. To operate them horizontally, the operator must depress the diverter valve, located on the floor, with his heel. Again, stressing safety, the operator can never make a mistake and perform one function when he intended to do another. Servicability of the machine is quite obvious. A mechanic can stand next to the machine with easy accessibility to each area. Visible are the swing motor, pump, hydraulic control valve, engine and hydraulic filters. The MENZI MUCK is powered by a Hatz 3-cylinder, air-cooled diesel engine which yields a maximum rating of 54 HP. The loadover height of the machine is 17 feet 1 inch, but by dropping the back, it can reach 28 feet. This is very important if you are clearing material out of an area by a trestle and have to cast it up on the bank. One thing the operators always comment about is its stability. They find that when working in steep slope applications or in swampy areas the performance of the machines exceeds their expectations. The operator is not restricted to working only off the front of the machine, but can cast and work in any direction.

Soft Ground and Drainage Work

One of the most common problems faced by the railway industry is flooded fields created by the beaver. Since the beaver needs water for his habitat, he builds his dams and causes swampy areas to be created. These interfere with the normal flow of water causing it to rise, often covering the bridge caps, making routine inspections difficult or impossible. Even in an area where beavers are not present, the trestle structure itself can hamper natural flow since drift and other debris build up.

The most efficient solution to this problem and other drainage problems is the MENZI MUCK Climbing Hoe. After observing what this machine can do and the dense, inaccessible areas into which it can travel, many people have called it amazing. The standard machine (picture A) has a ground pressure of

5.4 pounds per square inch. The ability of the horizontal movement of the stabilizers and tires gives the operator the option of either straddling the ditches or working in them. In extreme areas or environmental areas, a swamp package is recommended. Four foot swamp plates, plus two additional tires will drop the ground pressure to 2.3 pounds per square inch. This low ground pressure coupled with the ability to work in a combination of 6 feet of mud and water makes this an affordable solution to drainage problems.

Use in Track Maintenance

Picture "B" illustrates the machine in a normal track maintenance application. By using a cribbing bucket, tie replacing can be done swiftly. A normal option for the machine is tapping the hydraulics and setting it to run different types of hydraulic hand tools such as hydraulic jacks, hydraulic hammers with spiker points, and impact wrenches. A lift capacity of 7000 pounds will enhance the versatility of the machine when handling frogs and different types of heavy objects. A machine mounted on our high-rail system makes this a very mobile productive machine for track maintenance. Picture C shows the machine climbing a 10 foot vertical wall. When working in the mountains or around trestles, this feature can be very important in either clearing the track or going to a problem area. Picture D shows the machine coming down a 45 degree slope. Although severe for other types of conventional equipment, this requirement poses no problems for the MENZI MUCK Climbing Hoe.

A wide range of buckets is available from the factory. Dirt buckets range from 12 inches to 39 inches and rock buckets from 18 inches to 39 inches. Specialty buckets are also available like the tapered ditching bucket or the self cleaning type. All conventional buckets have the ability to be mounted and used as front shovels. This versatile feature is very important when cleaning dammed up areas by bridges.

Another accessory available for the MENZI MUCK is the winch. It is conveniently mounted on the back of the tire and has a multitude of uses for general track maintenance. Also available is the deep water package. This elevates the machine and enables it to work in up to 11 feet of water. A second consideration for the deep water package might be the unloading of ties. By elevating the machine to it's maximum point, a clearance of 9 feet is achieved. With the machine elevated, the operator has visibility into the rail car. Using a grapple, he can unload ties and place them where necessary. In this elevated position, the operator has a 360 degree clear view of the work site.

Use as a Pile Driver

Another optional feature would be a pile driver mast which easily adapts to the MENZI MUCK Climbing Hoe. Using the winch, it can handle quite easily a 10-inch "H" pile up to 35 feet long. This could also be very important when driving old rail for shoring. The concept of the machine is that it is an off the highway piece of equipment and therefore does not come with a drive package. It is moved by picking up the super structure with the backhoe and pushing or pulling to the desired position. If mobility is necessary when working the yard area, a mobile unit is available. This would give the machine a maximum speed of 7 miles per hour. Although the drive unit does give good mobility in good ground areas, it adds weight to the machine and reduces maneuverability when working in the slope and mud conditions.

In considering the requirements of the railway industry, this has been only an overview of the application of the MENZI MUCK Climbing Hoe.

Question: That rail dolly, does that give him the capability of moving that dolly off the track? The weight is such that he can set it off?

Mr. Vaughn: Yes it is. It is designed such that you can use the bucket on the machine once you get to your work destination, pick the dolly up, set it off to the side, and go to work. Then when you get ready to move it you can catch it again with your bucket, and put it back onto the track. It is that well balanced.

I will tell you it is an amazing machine for what it will do and where it will perform and the terrain that it will work in.

I guess there isn't anything else. Thank you. (Applause)

President Denz: Thank you, Mr. Tallent and Mr. Vaughn for your special feature. The machine is truly amazing.

This will conclude the Second Joint Session of the Roadmasters and Bridge & Building Associations' conference. The Roadmasters will reconvene here in Regency Rooms C and D at 10:45, and the B & B will meet in Regency Room B. Please assemble promptly in both locations as we have full schedules.

President Hernandez, do you have anything else to say?

I declare this session closed.

. . . Recess . . .

TUESDAY MORNING

President Denz: This meeting will please come to order. The second session of our 88th Conference is now in session. We have a few brief introductions to make. To my right is Junior Vice President, J. M. Williams, B&B Supervisor with the EJ&ERR; second to my left is Junior Vice President, Don Bessey, Assistant Chief Engineer with the Milwaukee Road, Chicago, Senior Vice President, Jim Budzileni, Senior Structural Designer with the ICG. Next on the program is special feature No. 3 which will be introduced by Senior Vice President, Jim Budzileni.

Mr. Budzileni: Thank you President Denz. Special Feature No. 3 is "Underwater Inspection of Railroad Bridges" and the speaker is Thomas J. Collins, President of Collins Engineering, Chicago, Illinois. Mr. Collins holds a Bachelor of Civil Engineering from Marquette University and a Master of Business Administration from the University of Connecticut. Tom is also a registered sturctural engineer in the State of Illinois and a registered professional engineer in a number of other states. As a certified diver, he has conducted underwater investigations of bridges, dams, dockwalls and intake structures for federal, state and local agencies, railroads, and private industry throughout the United States. Mr. Collins' professional affiliations include the American Society of Civil Engineers, the Society of American Military Engineers, and the American Railway Engineering Association. Mr. Collins is also a member of AREA Committee 15. Mr. Collins.

Thomas J. Collins

Underwater Investigation of Railroad Structures

By Thomas J. Collins

Collins Engineers, Inc.

Railroads have been inspecting bridges and waterfront structures since the mid 1800's and have developed some of the most effective inspection and maintenance programs of any organization responsible for bridge safety. One of the reasons for the effectiveness of these programs has been the intimate knowledge that a railroad bridge inspector has of each bridge in his territory. But even bridge inspectors, who carefully monitor the condition of bridges above water, often neglect a most basic portion of the bridge, its foundation, when it is hidden below water.

Each year there are bridges that fail because of deterioration and scour which is hidden below water. Some engineers estimate that as many as half of all bridge failures are related to foundation problems located underwater.

Bridges have generally not been inspected below water—except in the case of especially large or important structures—because it is often thought that an underwater inspection is very costly or difficult to conduct. Until the last few years, that may have been the case, but there have been recent significant improvements in underwater inspection techniques that have changed the picture dramatically.

Diving inspections can not only be a safeguard against bridge failure but are also useful as part of general bridge maintenance and repair programs. In bridge rehabilitation projects, often the cost of a diving inspection is very small compared to the savings that can be realized. For example, when a bridge is struck by a marine vessel, it is often apparent that damage has occurred at and above the waterline, but in order to prepare contract documents for repair work the engineer needs to know how extensive the damage is below water. Without knowing the limits of the damage he will not know whether to specify minor patching at the waterline, call for a costly cofferdam to make major repairs, or require construction of an entirely new foundation system. A diving inspection can remove this uncertainty and result in lower bids for the work.

In the following sections, we will look at the types of distress found underwater; discuss the methods of conducting underwater investigations - primarily the use of divers and sounding equipment; discuss how to prepare for and conduct an underwater investigation; and consider the personnel and insurance requirements that bridge owners should specify for underwater inspections.

Three primary causes of underwater distress are deterioration of the structural material, damage from marine traffic, and undermining and loss of lateral support due to scour.

Deterioration of the structural material is caused by factors in the environment in which the foundation element is located. The type of deterioration found will depend on the type of material, but usually it will be more severe in water because the factors which cause the deterioration are usually present and more severe at the waterline. For example, concrete is susceptible to scaling, spalling, cracking, and chemical attack; steel corrodes; and timber suffers from decay and marine borers.

Scour Investigations

Scour—the erosion of riverbed material from around and beneath bridge foundations by water currents—is a too often neglected aspect of bridge safety. Because

the early signs of scour are hidden under water, it is often difficult to justify the cost of conducting a search for unseen problems. Problems of undermining and loss of lateral support normally are not detected until they are extremely serious or disastrous. Even if scour does not reach catastrophic proportions, it can manifest itself in less spectacular, but still extremely costly symptoms such as settlement of piers, misalignment of joints and bearings, and binding of movable spans.

Scour occurs when the velocity of the water is great enough to pick up materials from the channel bottom and transport them downstream. Scour holes that form at bridges are generally deepest at the upstream nose and extend along the sides of the pier. Sometimes the holes also extend downstream, forming a bar. This pattern may vary when the pattern of flow at the pier is not simply upstream to downstream. Nonalignment of the piers with the channel, obstructions in the channel, extreme turbulence below dams, and reversal of flows, such as that which may occur near the junction with another waterway, can alter the usual pattern.

The most common source of scour is the change in flow caused by seasonal variations. In most rivers, as the flow varies, there are moderate scouring and filling cycles, so that the streambed reaches a state of equilibrium for extended periods. It is changes in the scour-fill cycle that are of concern. These changes can be caused by unusually large storms, changes in runoff characteristics of the watershed, construction or dredging activities upstream, and obstructions in the channel such as debris, trees, or sunken barges.

Soundings can be made by three methods: pole, leadline, and fathometer. In shallow waters, the configuration of the channel bottom can be determined by sounding with a long graduated pole. As the water becomes deeper, a leadline can be used. In fast flowing, deep channels, however, accurate readings are difficult to obtain from a leadline because the current tend to carry the line and its weight downstream. The most inexpensive types are digital "fish finders". More sophisticated units are equipped with an internal recording device that simplifies plotting river bottom profiles and cross sections. These electronic depth-finding instruments can also be used during periods of high water, when significant scour is most likely to occur, but when currents would preclude the use of leadlines and sounding poles.

The pattern of soundings to be taken around a bridge will vary depending upon the channel size and flow characteristics, but generally will include the upstream and downstream faces of the bridge; lines parallel to the face of the bridge at 50 feet, 100 feet, and 200 feet upstream and downstream of the bridge, and around each pier of the bridge.

After the soundings are completed, preliminary plotting should be made of the channel bottom to detect any unusual conditions or profiles that may require further field study.

The sounding data should also be correlated with the plans of the bridge foundations to determine if the foundation elements are adequately covered by the channel bottom.

Trees and debris often collect around the base of structures in water, and care must be taken to ensure that this debris is not mistaken for the channel bottom. Sometimes a diver can actually view the channel bottom and note if the foundation is exposed or undermined. When there are no plans available, sounding alone will not indicate undermining or exposure of the foundation elements.

Diving Inspections

Diving equipment can generally be divided into two types: (1) surface supplied equipment, the most common type being hard hat or deep-sea equipment, and (2) self-contained equipment or scuba, an acronym for Self-Contained Underwater Breathing Apparatus. For both types, the usual breathing medium is air, but mixtures containing oxygen, helium, and other gases can be used for specialized types of diving. Both types of diving equipment permit work at depths in excess of one hundred feet, which is far greater than normally required. Most underwater inspections are conducted in less than

30 ft of water, and those in water deeper than 50 ft are unusual.

When conditions are dangerous, the water polluted, the task arduous, of long duration, or bottom-oriented, surface supplied equipment is well suited for the work. The great disadvantage of surface supplied diving is the size of the operation necessary to support the diver. The old deep sea equipment worn by the diver alone weighs about 200 pounds. Add to this the compressor, hoses, lines, and, possibly, a diving launch to work from, and the problems of mobility and transportation become significant. The cost of hard hat diving is usually quite expensive. This equipment had changed very little in over one hundred years until about twenty years ago, when more sophisticated lightweight surface supplied equipment started to come into use. The boom in offshore oil rig operations in the last ten years has greatly changed the field of surface supplied diving. Lightweight surface supplied equipment combines some of the advantages of both deep sea and scuba equipment.

Scuba diving, in contrast to surface supplied diving, is especially suited for conducting inspections in which mobility is a prime consideration; many dives of short duration at different locations being required, rather than one sustained dive. Scuba equipment weighs less than 75 pounds, is relatively inexpensive, and does not require as elaborate support operations. The depth requirements of most inspections are well within the capabilities of the scuba diver. Generally the maximum sustained working depth for scuba diving is about 60 feet. For short periods of time, depths to 130 feet normally present no special problems to experienced divers. The amount of time that a scuba diver can stay below water varies with the individual. Generally, with a single tank, a scuba diver could work at a depth of 30 feet for 30 or 40 minutes. As the depth or level of exertion increases, the 'bottom time' will decrease.

The preparation for a diving project is essential since the cost of a commercial diver can be very high, and diving is inherently dangerous. When using a commercial diver, as much preliminary work as possible should be done before the diver arrives.

One of the problems in employing a commercial diver for bridge inspection work is that the diver is not normally an expert in structures; for his work, he must be a jack-of-all-trades. Since the diver is not technically trained, he will not have the technical vocabulary to report precisely what he encounters. The engineer responsible for the inspection must insure that the diver is taught to recognize the indicators of the sturcture's condition. He must be instructed to report such things as spalled and scaling concrete, corrosion, cracks, and deformation. It must be emphasized to the diver that he is to report everything he encounters. Although the diver may not realize the significance of his observations, they may be important to the engineer. It has been our experience that because the commercial diver may not understand what he sees, he often becomes too alarmed about minor deterioration and distress.

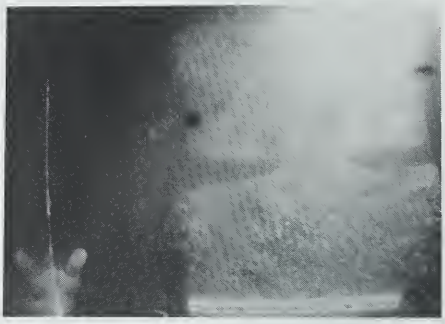
In making a diving inspection, the diver should have with him or immediately available from the tender or stand-by diver, tools for probing, measuring, and recording the results of the inspection. Hammers, picks, prybars, probing rods, scraping tools, and similar devices should be at hand. For measuring, generally a graduated rod is an adequate and convenient tool to use underwater. In some instances, calipers and tapes can be used underwater. For measuring the remaining thickness of steel members underwater, an ultrasonic thickness measuring device can be used.

Most bridges, which are large enough to require an underwater inspection, are located over fast-flowing rivers with little or no underwater visibility. These conditions present special problems for the diver and can affect the information that can economically be gathered during the inspection.

The use of scuba divers, trained as inspectors, and especially, engineers trained as scuba divers, is generally more than sufficient—and economical—even when conditions are adverse.

In a typical river pier inspection, the diver must cope with currents of 2 to 3 knots and visibility of less than 1 foot. Usually, the diver will be tethered, and, working from a launch anchored at the upstream end of the

Diver inspecting prestressed concrete piles



View of deteriorated H-pile flange looking through clearwater box

Diver inspecting crack in concrete wall

pier, will be let out along each face a number of times at various elevations. With underwater lights, and his face only a few inches from the structure, he will be able to determine visually, but primarily tactilely, the condition of the pier.

The upstream and downstream noses of the pier, which are most susceptible to vessel damage, material erosion, and scour, can be inspected with much greater ease and in much greater detail, because at the upstream end, the current holds the diver in place; at the downstream end, there is little current.

Where the current is not as severe, or the construction of the pier is such as to provide a number of handholes, the diver will be able to propel himself across the faces of the pier. In tidal waters, it is often possible to plan the dives for times of day when the tidal currents are minimal. In river work, if possible, inspection should be scheduled for periods to low flow, generally from August to January.

One of the biggest advantages of an underwater scuba inspection is its low cost, because of minimum needed equipment and support operations. It allows an inexpensive inspection of bridge foundations that might not otherwise be made. The reporting and recording techniques should be consistent with that idea.

Generally, the most efficient method of reporting the inspection results is for the diver to dive, inspect, surface, and report his findings to a recordkeeper in the boat. It is simple, and it is all that is normally needed.

If detailed notes in large quantities must be reported, an umbilical communication system or underwater radiotelephone system can be used. Even with scuba equipment, special masks and earphones have been developed that permit divers to communicate with the surface.

When the importance of the structure warrants such methods and water conditions permit, still photography, motion pictures, closed circuit television, and videotape can provide a pictorial record of the inspection. The cost of these special methods has been reduced significantly in the last few years. Specially sealed 35mm cameras and strobe lights can be used for underwater still photography. When suspended materials in the water reduce visibility to a few inches, pictures can usually be taken by shooting through a clear acrylic plastic box filled with clean water. Underwater video cameras and video recorders can also be used for "real-time" above water viewing.

Any or all of these methods might be used for a specific job, although still color photograph of significant conditions is usually most convenient. Photographs can most easily be included in reports and filed for review and comparison at a later date.

Safety, Insurance, And OSHA

Diving, even though it is a popular sport, can be dangerous, particularly in rivers where most bridges are located. It is not a place for a novice or a sport diver. When employing a diver, a bridge owner should be certain that the diver is experienced in conditions to be encountered; has adequately planned, equipped and prepared for the task; conducts his diving operations in accordance with applicable local and federal safety regulations; and is properly insured to protect the owner.

In November, 1976, The Occupational Safety and Health Administration of the Department of Labor and the Coast Guard issued Commercial Diving Standards which were subsequently included as Subpart T—Commercial Diving Standards of Part 1910—Occupational Safety and Health Standards. These standards apply to all commercial diving operations, including the underwater inspection of bridges. They also provide a standard against which the bridge owner can judge the adequacy of the safety precautions of diving operations.

The owner should require insurance certificates from the diver indicating his coverage. There are a number of special types of insurance that are necessary for diving and marine work. Listed below are the suggested coverages and limits based on the requirements of some railroads or public agencies.

The limits shown may be covered under a basic policy or as part of an excess liability or umbrella policy.

Insurance	Limits
A) Worker's Compensation discussed (Basically a no-fault type of insurance covering injured employees for lost time and medical expenses)	Statutory Requirements
Longshoremen's Act Insurance (Similar to Worker's Compensation Insurance, but applies to work over water)	
Jones Act Insurance (Similar to Worker's Compensation Insurance, but covers members of crews of vessels)	
B) General Liability Insurance (Provides coverage against suits for bodily injury and property damage by third parties)	$2,000,000
C) Automobile Liability	$2,000,000

When the work is performed by consulting engineers, the firm normally also carries Professional Liability Insurance and Valuable Papers Insurance which can provide additional protection for the owner.

Conclusions

Although underwater television and videotape systems are now available to bring the findings to bridge inspection at the surface, such systems are expensive to employ, of limited value in silty waters, and only as good as the skill and knowledge of the diver directing the camera. Training the structural engineer or bridge inspector as a diver can overcome this problem and has many advantages. The reliability and comprehensiveness of the underwater inspection is greatly enhanced when the diver is a structural engineer also. The engineer knows what to look for and can recognize the structural importance of unexpected and abnormal conditions he encounters. The advantages gained using an engineer diver are particularly clear when the diving conditions are adverse and "bottom time" is at a premium, as it always is. The engineer can evaluate what he encounters and spend the amount of time commensurate with his estimate of the structural condition. Integration of the diver with the bridge inspection teams, particularly when the diver is a structural engineer, can significantly improve the effectiveness and efficiency of the team. With the use of scuba equipment, the cost of a diving inspection need not be prohibitive. Even structures that have not experienced scour problems for many years need periodic scour investigations, because channel bottom equilibrium can change.

Underwater investigation of bridge elements can reduce the uncertainty below the waterline. This is a very inexpensive form of protection—especially in view of the potential savings to be realized through early detection and correction of deterioration and scour problems.

President Denz: Thank you Mr. Budzileni and Mr. Collins for your presentation which was very interesting and also very inviting for those who like to swim beneath the water. Our next special feature will be introduced by Mr. Budzileni.

Mr. Budzileni: Special Subject No. 4, is "Cost Effective Electronic Control of Buildings". Our speaker is Mr. Mark Walbrun, Manager Engineering Design, for Amtrak in Philadelpha. Mark currently directs the electrical, mechanical, and civil design of facilities for Amtrak nationwide. Mark has a Bachelor of Science in engineering from the University of Illinois and works both on civil and electrical projects. He is interested in computers which has led him to today's talk. There will be a demonstration of some equipment after Mark's talk in the back of the room. Mark.

Cost Effective Electronic Control of Buildings

By Mark Walbrun

Manager, Engineering Design, Amtrak

Last year at the combined conferences in New Orleans, Mr. Herb Longhelt, Deputy Chief Engineer of Amtrak, made a presentation about the new Amtrak Chicago Maintenance Facility. In that presentation, Mr. Longhelt showed the multitude of new buildings and support facilities that Amtrak constructed to service and maintain locomotives and passenger cars. For those of you who did not have a chance to see that presentation, I would like to take a few moments to acquaint you with the Chicago Yard so you too may be familiar with the supervisory challenges this facility offers to the B&B supervisor or engineer.

Terminal Description

Amtrak's Chicago Maintenance Terminal lies just south of Union Station along the south branch of the Chicago River. The focal point of our midwest operations, it encompasses a 48-acre site containing three 100,000 square foot buildings, a 1,200-foot train inspection shelter, 13 miles of track including four separate yards, fully distributed utilities, roadways and platforms, and a drawbridge. Activities handled include train servicing, car repair, locomotive service and repair, commissary stocking, materials supply, engineering, and administrative service. Each building contains elevators, air compressors, heating, ventilating, and air conditioning systems, secure areas, and fire protection equipment. Amtrak's B&B Department is charged with the maintenance for most of this equipment.

Current staff consists of 6 electricians, 8 pipefitters, 6 carpenters, and 17 trackmen working one shift Monday through Friday. Along with the yard, the Engineering Department is also responsible for the closed Brighton Park Facility 3 miles away and the 24 hour Reservation Center one mile away at 55 East Monroe Street. As you can see, the Engineering Department is spread pretty thin especially during the night and weekend hours. Like most railroad facilities, Amtrak must operate 24 hours per day, seven days per week. The B&B side of the yard maintenance force only has 20 men, and being able to call the right crafts to solve problems is most important.

Previous to the installation of the ACS (Alarm and Control System) many components scattered around the yard could fail and be undetected for hours to days. Utility systems that were critical for servicing or operations required rapid response to problems. Unfortunately, that was simply not possible over a 48 acre site without continuous patrols to check sump pumps, electrical trips, pressure gages, overflow alarms, air compressors, etc. Even when received, a trouble call might state that the "air conditioner is not working." To call a refrigeration mechanic or sheet metal worker does little good if the problem is traced to a circuit breaker or electrical control. Subsequently, an electrician will also be called, but the other crafts called in will also receive at least minimum payment as provided for under the labor agreements, even though they were not needed. It is this type of trouble shooting and problem identification that makes electronic monitoring very cost effective.

Amtrak's passenger yards operate very similarly to a freight yard. Along with a dispatching area there is a car repair facility, locomotive service and repair, pollution control, warehouse, and administrative and

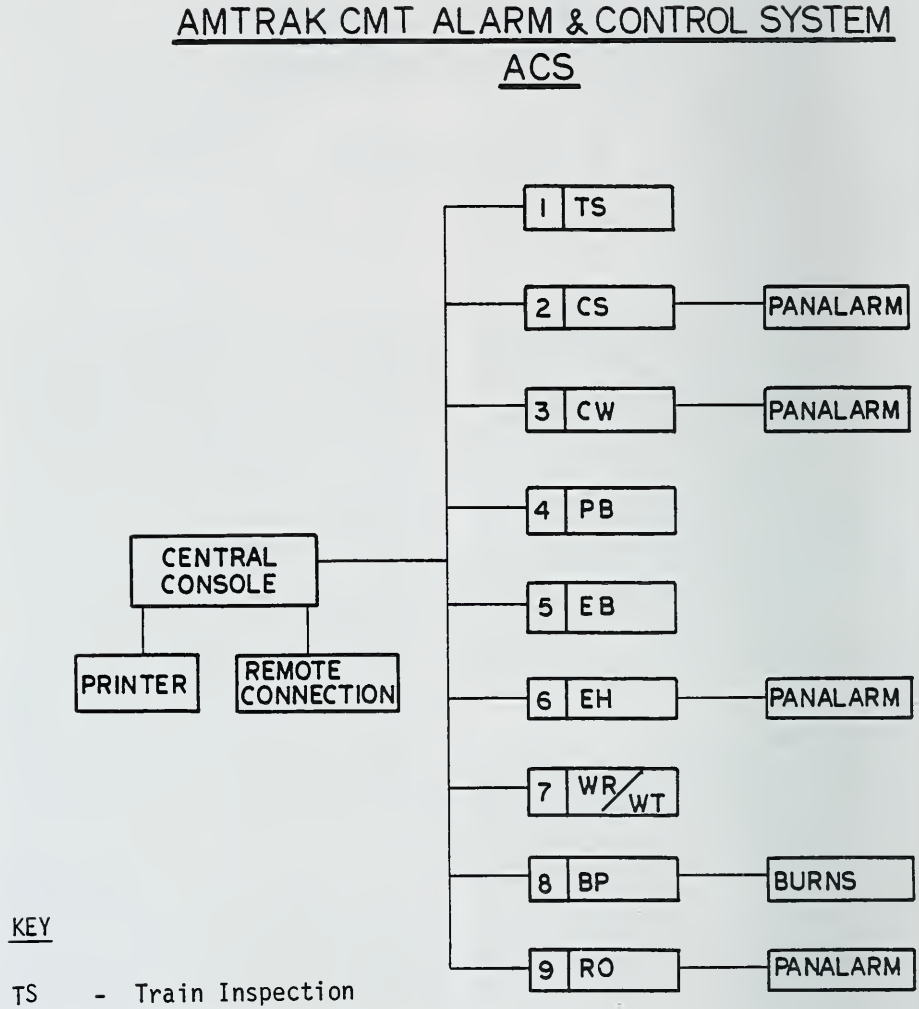


FIGURE 1—Block Diagram of the Alarm System with an encoding panel at each of 9 locations to digitize the monitoring signals. A single pair of communication wires connect all of the encoding panels with the central console. The remote connection to the console permits supervisors to access the system to read the display from their office or home using a portable terminal and modem.

Several buildings had local alarm and annunciator panels installed as part of the original construction. When buildings were unoccupied, the alarms were not monitored. The cabinet to the right of the annunciator converts the individual alarms to a digitized signal which is transmitted to the central processor.

The central processing unit has a video display terminal which displays all events, a keyboard for the operator to acknowledge events, and a printer (to the right of the CRT) that makes a paper printout of all events. This console is located in the Operations Center which is manned 24 hours a day.

train inspection areas. The commissary and car washer are probably our only unique items. Equipment to heat, ventilate, air condition, and elevate people is the same. Utilities such as electric power, steam, compressed air, gas, sewers, and communication lines exist—and fail—for us also.

Electronic Sensors

Five years ago, centralized control and monitoring was very expensive and could not be justified except for the most important or valuable facilities and equipment. Systems typically required hundreds of wires to fan out from an expensive control console to each individual sensor. While the cost of a sensor may be small (usually under $10) the wiring is not. The console was also very expensive since it required one or two lights for the condition of every sensor—much like a nuclear power plant.

Computers, as they have so often this decade, have changed all that. By giving the sensor an electronic address, a microprocessor can selectively "ask" each sensor its status one at a time. It can then do this many times a second over one pair of wires by continually "addressing" each sensor and waiting for it to respond. The process is similar to that of a touchtone phone or a ctc signal system. If a problem has occurred, that sensor will then signal the processor that its condition has changed which will be translated to a visual message on a video display for the operator.

The sensors basically act like a switch. If the content is closed—then everything is OK; if it opens up—then a problem has occurred. For instance, a steam pipe can be equipped with a pressure sensor to open up when the pressure drops below, say, 90 pounds. A thermostat makes a good temperature sensor; a magnetic door switch is a very good burglar alarm; a mercury float switch can advise you before a tank overflows; a simple relay can tell you all about your power system; a smoke detector can give you lots of notice of a fire. Basically, if it opens and closes a contact, it will work as a sensor. Of course, there are very sophisticated sensors on the market for specialized needs and they too can be added to a system.

With the cost of computers dropping everyday, a microprocessor costing $10,000 with maybe $15,000 worth of sensors and wiring can easily monitor over 100 different items. The wire may even be existing in the form of a spare pair on an old intercom or PA system. A system can include monitoring of any problem that can be sensed with a device that triggers an electric contact. Possibilities include water pressure losses, compressed air pressure losses, either high or low steam pressure, air conditioning failure, refrigerator/freezer temperature malfunctions, burglar alarms, elevator failures, electric power problems, fire alarms, product tank levels, or any local alarms from other devices. The sensors don't even have to be near the wire pair from the console. Radio and phone links are available that allow monitoring across the city, state or country. Amtrak uses these for monitoring Brighton Park and the Chicago Reservation Center. If a device can fail, it can usually be monitored from one of these systems.

The Central Console

The central console can be located anywhere that gives good coverage, presumably 24 hours, by trained personnel who can dispatch the proper craft to the problem. But, maybe repairs aren't always necessary immediately. If a system that has failed can be fixed by a changed valve setting, motorized breaker, reset control, or other electric operation you can simply command the device via the monitoring system to change. Hence, if a water pressure sensor indicates a leak in a noncritical line at 3:00 a.m., you could just tell the branch valve to close, and attend to the problem in the morning. It is even possible to control the central console remotely from your home or hotel room via phone lines. This option gives you the ability to evaluate a situation and correct it without even leaving your location where paged.

Picture this: It's 2:30 on Saturday morning. Your phone rings. The diesel foreman is complaining that the fuel pumps at the diesel pit won't pump. The overnight piggyback express is due in just one hour. Delays to that train will mean an uncomfortable session with the Division Superintendent Monday. As B&B man for the division, your electri-

cians and pipefitters maintain the pump equipment. You simply call the operations desk and ask if the fuel pump level sensor or the power sensor went off. He says power. You check your reference book. You tell the Diesel Foreman, "Reset circuit breaker 12 on the panel by the door." You go back to sleep.

System Evolution

Amtrak's system evolved from mandatory fire alarm and existing burgular alarm systems that resided in each building. The ACS system was overlayed and interconnected to these systems. Amtrak employees then installed additional sensors such as overflow and pressure alarms, a group of transponder sets, a Pyrotronic central processor, and some telephone communications interface equipment. Total cost was under $50,000. Seven of the nine transponders are located in buildings in the yard. They are connected by simple twin lead #22 AWG wires to an extra line on our existing public address circuits. The other two are located in facilities several miles from the yard, but monitored through two leased line telephone circuits.

To actually hook up an alarm, the following procedure is used:

1. Connect 2 wires from the transponder box to the alarm contact (say on a smoke detector).
2. Connect the transponder to a 110-volt power supply and in parallel to your "system" pair of wires.
3. Command the processor to start watching the new transponder and alarm.

Railroad forces can usually install an entire transponder in one day. Power consumption is minimal. Reliability is very high. To make the system installable and maintainable with railroad labor, the communications circuits use simple DC circuits familiar to C&S personnel. The sensors are easily installed by pipefitters, sheet metal workers, or electricians depending upon what medium is being sensed. The digital transponders are modular and can be troubleshooted by replacing plug-in modules. The system is supervised, so that any break in the wiring is printed as a failure or trouble.

The console is located in the Western Region Control Room in the yard tower. Calls are referred as shown in the system guide. When an alarm sounds, the system operator looks up the meaning in the Amtrak ACS manual. He evaluates other variables like time and outside temperature, and then he contacts the duty person as shown.

System maintenance is easily accomplished by railroad electricians and pipefitters (for sensors) and C&S personnel (for system interconnection). A printer associated with the system provides a good record of occurrences, times, and responses taken. Supervisors can review an entire week's problems at a glance to spot maintenance trends.

A yard, being the focal point of railroad activity, has many diverse components and functions connected through a complex communications network to support the decisions of and supply information to those supervisors in charge. The monitoring of utilities, the protection of equipment, the security of the site, and employee safety are all concerns of railroad yard management. When timely decisions must be made, fast accurate information on all of these elements can be used to speed response, determine options, and control the situation. Electronic monitoring can be used to meet these needs.

President Denz: Thank you Mr. Budzileni and Mr. Walbrun for your timely and interesting presentation. I have to admit, Amtrak is right on time, five minutes to 12! I'd like to remind you that there are copies of the special subject reports available in the rear of the room. If there are no other comments we will now adjourn for lunch until 1:30 sharp at which time this meeting will be resumed in this room. Meeting adjourned.

TUESDAY AFTERNOON SESSION

President Denz: Welcome to the continuation of the B&B Second Session of this conference. Will everyone please be seated while someone closes the doors. Latest attendance figures shows the Associate members 275; Roadmasters 183; B&B 83; guests 89, a total of 630 and ladies 115. We have a little change in program here, we have inserted an added short subject, "Prestressed Concrete Girders" which will be presented by Jim Davidson.

Mr. Davidson: I'd like to mention this is primarily a presentation by Portland Cement Association. They provided some slides. Unfortunately they did not provide a speaker, so I'm going to handle that end of it. This is a story about a large construction job involving a large number of concrete box girder prestressed beams, probably the largest number in any one project for railroad use undertaken to date. (WHEREUPON THERE WAS A SLIDE PRESENTATION)

President Denz: Thank you, Jim. You did a wonderful job. Jim didn't have much notice on that, and he did extremely well. At this time we wish to recognize our presidents who have directed our association in the past and who are in attendance today. Will Mr. Hyma please come forward to introduce our past presidents who are with us today.

Mr. Hyma: The current membership of our association owes a great deal to those who have served as officers in the past. It is through their efforts and dedication that the association has been maintained and grown to its present status. Therefore it is a pleasure to be able to give recognition to those of our past presidents in attendance today. I'll ask each of you to remain standing until all have been introduced. H. M. Wilson, President 1965-1966; R. D. Helleweg, President 1966-1967; N. D. Bryant, President 1972-1973; J. R. Williams, President 1976-1977; W. C. Sturm, President 1978-1979; and, out of sequence here, J. R. Iwinski, President 1977-1978; J. W. Chambers, President, 1980-1981. Let's thank these gentlemen with a round of applause.

Left to right: J. W. Chambers, W. C. Sturm, J. R. Williams, N. D. Bryant, R. D. Hellweg, H. M. Wilson, J. R. Iwinski.

President Denz: Our association elects three members each year to serve as directors just as we will do this year. On behalf of the association I wish to thank our three outgoing directors, Mr. Anthony, Mr. Kapp and Mr. Lewis for their efforts and dedicated service to the Association and assistance during my term as president. Will you gentlemen please come forward? As an expression of the Association's appreciation for your efforts and service, I am pleased to present these plaques to you. As past president and chairman of the nominating committee, Mr. Hyma will present the slate of candidates recommended by the Committee for consideration at our election of officers. Mr. Hyma.

Mr. Hyma: The Nominating Committee respectfully submits to the membership the following slate of officers and directors with the recommendation that they be elected for the term specified. For President, James Budzileni, Senior Structural Designer, ICG RR, Chicago. Senior Vice President, J. M. Williams, B&B Supervisor, EJ&E, Gary, Indiana. Junior Vice President, D. A. Bessey, Assistant Chief Engineer Structures, Milwaukee Road, Chicago. Junior Vice President, J. T. Kapp, Staff Engineer Construction, Conrail, Philadelphia. For Directors with term ending in 1986, Byron T. Burns, Steel Bridge Inspector, AT&SF, Topeka, Kansas; John J. Horney, System B&B Supervisor, Union Pacific, Omaha; William J. Semioli, Editor, Railway Track & Structures Magazine, Chicago, and for Treasurer, Paul H. Saletnik, Engineer of Buildings, C&NW Transportation, Chicago

President Denz: You have heard the Slate of Nominees recommended by the Nominating Committee. Are there any further nominations from the floor? There being no other nominees, I will accept a motion that the Slate submitted by the Nominating Committee be elected.

Member: I move that the slate submitted by the Nominating Committee be accepted.

President Denz: Do I hear a second?

Member: Seconded.

President Denz: The motion has been made and seconded that the slate of candidates recommended by the Nominating Committee be elected to the offices specified. All in favor signify by "Aye". Those opposed "Nay". The "Ayes" have it. I hereby declare these officers duly elected. Will the newly elected officers stand and be recognized. The installation will be made tomorrow morning at the Joint Session. We will now proceed with our business session and provide the necessary reports. If there is some question concerning any one of the reports I request you hold them until the report has been given.

Will our very able Secretary, Mrs. Pat Weissmann, deliver the secretary's report? Pat.

Mrs. Weissmann: Thank you President Denz.

MEMBERSHIP REPORT
September 1, 1982 to August 31, 1983

ACTIVE MEMBERS

Total Active members—September 1, 1982		437	
New Active members since September 1, 1982		70	
Reinstated—paid back dues		2	
		509	
Less: Transferred to Life	13		
Dropped	40		
Deceased	1	54	
TOTAL ACTIVE MEMBERS			455

ASSOCIATE MEMBERS

Total Associate members—September 1, 1982		99	
New Associate members since September 1, 1982		5	
Reinstated—paid back dues		1	
		105	
Less: Transferred to Life	1		
Dropped	13		
Deceased	1	15	
TOTAL ASSOCIATE MEMBERS			90

LIFE MEMBERS

Total Life members—September 1, 1982		156	
Transferred from Active	13		
Transferred from Associate	1	14	
		170	
Less: Transferred to Honorary	3		
Deceased	7	10	
TOTAL LIFE MEMBERS			160

HONORARY MEMBERS

Total Honorary members—September 1, 1982	7	
Transferred from Life	3	
TOTAL HONORARY MEMBERS		10
TOTAL MEMBERSHIP—ALL CLASSES—AUGUST 31, 1983		715

August 31, 1982

Active	437
Associate	99
Life	156
Honorary	7
	699

President Denz: Thank you Mrs. Weissmann. Will our Treasurer, Mr. Paul Saletnik, please read the Treasurer's report?

Mr. Saletnik: Thank you President Denz.

TREASURER'S REPORT September 1, 1982 through August 31, 1983

Checking account balance, August 31, 1982		$ 7,138.43
RECEIPTS		
Dues	$ 6.690.80	
Advertising—1980	325.00	
1981	4,685.98	
1982	10,530.01	
1983	1,420.20	
1982 Conference receipts	5,533.79	
Miscellaneous	63.00	
Interest on checking account	294.26	29,543.04
		36,681.47
DISBURSEMENTS		
Salaries (secretary and assistant)	$ 6,005.40	
FICA (on payroll)	390.05	
Department of Labor	9.22	
Illinois Unemployment Insurance	7.98	
Office rent, telephone, and electricity	707.27	
Postage	951.11	
Office supplies	92.18	
Advertising—1980	130.00	
1981	5,743.32	
1982	1,113.00	
Membership certificates	115.63	
1982 conference expenses	188.00	
1983 conference expenses	113.34	
1981 Proceedings	4,316.63	
1982 Proceedings	5,376.23	
Printing and Stationery	965.03	
Purchase of new equipment	164.05	
Equipment rent and repair	142.32	
Audit fee (Form 990)	200.00	
Fire inspection and fire insurance policy	15.96	
Magazine subscriptions	5.95	
Miscellaneous	213.28	26,965.95
Checking account balance, August 31, 1983		$9,715.52

Balance, August 31, 1982—$7,138.43

President Denz: Thank you Mr. Saletnik. Will Mr. Iwinski, Chairman of the Auditing Committee, present the Audit Committee's report?

Mr. Iwinski:

September 6, 1983

TO: MEMBERS OF THE AMERICAN RAILWAY
BRIDGE AND BUILDING ASSOCIATION

Gentlemen:

The undersigned have examined the books of the Secretary and report of the Treasurer for the period from September 1, 1982 through August 31, 1983, inclusive, and have found them to be correct as of August 31, 1983.

Respectfully submitted,
Auditing Committee
J. R. Iwinski, Chairman
J. R. Williams
H. M. Wilson

President Denz: Thank you Mr. Iwinski and your committee for this report. Are there any questions regarding the reports as presented by our Secretary, Treasurer and the Auditing Committee? If there are no questions or discussion, I will request a motion that these reports be approved as given.

Member: I move that the foregoing reports be approved as presented.

President Denz: Do I hear a second?

Member: I second.

President Denz: The motion has been made and seconded that the Secretary's, Treasurer's and Auditing Committee's reports be approved. All in favor say "Aye", those opposed "Nay". The "Ayes" have it. The motion is passed and the reports approved.

Will Mr. Anthony please read the Necrology Report.

Mr. Anthony:

To the President and Members of the
AMERICAN RAILWAY BRIDGE & BUILDING ASSOCIATION:

It is with grief and regret that we report the known loss of ten members through death during the past year. It is possible that other members have passed away during the year of whom we have no information. If you know of any, please report their names to the Secretary. The following have been reported since our last Annual Conference in October 1982:

ACTIVE MEMBER	TITLE-RAILROAD-LOCATION	JOINED	DECEASED
D. L. Nord	Staff Engr.-Structures Illinois Central Gulf Chicago, IL	1960	1983
ASSOCIATE MEMBER			
K. L. DeBlois	Engineer Highland Park, IL 60035	1970	1982
LIFE MEMBERS			
H. B. Christianson	Special Engineer C.M.S.P.&P. Rancho Palos Verdes, CA	1928	1979

E. T. Cross	Vice President Armco Steel Corp. Benton, KY	1946	1983
B. M. Hickok	B.&B. Supervisor New York Central N. Olmsted, OH	1951	1982
E. W. Kieckers	Building Engineer Missouri Pacific Ballwin, MO	1958	1983
A. L. Leach	Asst. Engineer Bridges Illinois Central Gulf Homewood, IL	1955	1980
H. E. Smith	President & General Manager Galveston, Houston & Henderson Crystal Beach, TX	1941	1983
W. B. Throckmorton	Consulting Engineer C.R.I.&P. Green Valley, AZ	1957	1983

and Past Secretary Ruth Weggeberg, who was secretary from 1958 to 1970, passed away in August of this year.

Respectfully submitted,
O. D. Anthony, Chairman
Necrology Committee

President Denz: I suggest we pause in memory of those who have left us.

Now we will move along with our next special feature which will be introduced by Mr. Davidson.

Mr. Davidson: May I introduce Mr. Jack Bushmeyer of the Owens-Corning Corporation who will tell you all you ever wanted to know about installing underground fiberglass tanks.

Mr. Bushmeyer: This is true! Thank you very much. What I'm going to do today is really not much of a sales pitch but to inform you of the proper way, techniques, and maybe some options, you as the engineer can store fuels in our tanks and also, what is most important, the proper way to put that tank in the ground. Fiberglass tanks have been around for almost 18 years. Owens-Corning, in conjunction with an oil company many many years ago, developed a tank into what you're going to see today. Our current model, it's called our G model tank. The thing about fiberglass that is different from any other tank that you put underground is that it does not corrode. It doesn't rust or suffer electrosis from stray currents, if you are still working with electric railroads, or anything like that. You just do not have any problems of that nature. Whereas with metal tanks, there is still the possibility of having some type of corrosion. The weak link in our chain, if you want to call it that, is that our tank does need to be installed properly. It needs to be put in the ground the proper way, or it will break. It's as simple as that. It's not quite as fragile as some people would lead you to believe, but it still needs the proper installation. A couple of things that we have done over the years, now in the G model tank, is a little different rib design on the side. We've got pictures of it back there, and we'll see a few of the slides up here. Also we have an in cap that has more of a cone shape which I'll explain a little bit later. It makes it much easier for you, if you're putting it in yourself, or for your contractor that you hire to put in a tank. There is no need to worry about your in caps drooping or something like that. It's a much more foolproof tank today than it was even 7 years ago. Now what I'm going to give you, and talk about today is our performance partners presentation. Throughout the United States we have what

we call "approved contractors." We have literally gone into their shops, taken their laborers, the foreman, the people out on the field and shown them how we want a fiberglass tank installed. The presentation that I'm going to give you (I've modified it a little bit) is the presentation that we give to these contractors to teach them how to properly install these tanks. So you'll see a portion referred to contractors or something like that. Again you're going to see exactly how we teach that contractor to put that tank into the ground, so if you're at a job site or have the time and place in your business you can go out and make sure that it's done correctly.

(WHEREUPON THERE WAS A SLIDE PRESENTATION—THE PERFORMANCE PARTNERS.

President Denz: Thank you Mr. Davidson and Mr. Bushmeyer for your interesting and informative presentation. Next on the agenda we have Mr. Saletnik to introduce the next subject.

Mr. Saletnik: Thank you Mr. President. The chairman of Special Subject No. 2 Recycling Old Buildings is Mr. Jack Campbell, Assistant Architect with Conrail.

Mr. Campbell:

SPECIAL SUBJECT NO. 2

RECYCLING OLD BUILDINGS

Chairman: J. A. Campbell, Asst. Arch., Conrail
Vice Chairman: C. M. Koch, Arch. II, Amtrak
Committee: R. E. Phillips, Asst. Arch. Engr., Southern Rwy. Sys.
G. A. Steiner, Asst. Engr of Bldgs., Chgo. and NW Transportation Co.
L. O. Bolwahnn, Arch., Milwaukee Road
R. C. Lund, Coordinator-Arch. Maint., Milwaukee Road
J. H. Smith, Bldgs. Str. Engr., Ill. Cent. Gulf RR.

I would like to begin by saying how glad I am to be included in the gathering of this very knowledgeable and professional group. I must confess I resisted the formality of group participation such as this for more years than I will say. However, in the past few months, during the preparation of this report, I have found that the sharing of thoughts and ideas while working with the Committee members has been a most pleasurable experience.

After I agreed to chair Committee 2 for this presentation, a choice had to be made as to what general topic concerning older buildings could hold this group's interest. What is of very real common concern to most of us who are involved in such restoration work?

Now, every worthwhile talk should have an underlying message that, whether subtle or strong, the audience will, it is hoped, remember.

As I considered a variety of subjects, the inspiration came—my underlying message would be the "DECISION", and I thus had the basis of inviting your interest and enthusiasm in what might seem to most to be a very dull topic, "The Recycling of Old Railroad Buildings."

However, an enthusiastic "DECISION" to recycle some of these old buildings does not come easily. By nature, my own inclination would be: if it's outmoded and very costly to maintain, tear it down and build a new and efficient structure. I assume many of you are of the same feeling in this regard. We often look through suppliers' catalogues or issues of *ENGINEERING NEWS RECORD* and, on occasion, see an idea or concept for a new building that could be of value to our own Railroad.

The Challenge

But how can we, and I say we to involve all

of you, wax eloquent about repairing, fixing up, converting, or recycling some 75-year old railroad building. I can't. Perhaps certain of you can, but I can't unless—and here is the interesting challenge—

> The "DECISION" is to make a large capital investment and recycle the building, or accept it as having zero value, and tear it down.

Very often, as we all know, the building under consideration is a broken down old shell. The "DECISION" is obvious and one need not be an expert to recommend its removal from the property. But suppose it is of border line or better value. Then we can have a real incentive to use our skills, to draw on our vision and imagination, our experience and talent. We then have the very essence of today's subject—"WHEN TO RECYCLE".

We collectively, here today, represent perhaps as good a cross section of railroad management as exists in the country who are on the, shall we say, "firing line," to determine the future worth of an older railroad building.

You will, I hope, pardon this digression, but since I did work in the MW Department for years, I know of the satisfaction, and yes, the thrill of replacing a bridge, the absolute need for keeping a safe bridge tie deck, and even the positive thinking behind keeping a respectable coat of paint on our bridges. But how are we ever to convince ourselves, let alone our respective managements, to give a fair share of what has been in recent years the most minimal of MW budgets, to allow the re-coating of an old built-up roof, painting dried out windowsills, or repair masonry walls that are starving for even a minimum of cement pointing?

A study of past volumes of this organization's *Annual Proceedings* well indicates the comparative interest between bridges or other miscellaneous structures and that shown for the preservation or redevelopment of our older buildings.

The glamour, if you will, is just not there. The engines and trains do, after all, go over the bridges, so the buildings can be deferred, and deferred, and deferred.

This perhaps highlights the most difficult part of our involvement: HOW, WHEN, and IF to redevelop, or recycle these older buildings into our modern railroad systems. That is the "DECISION".

Needless to say, much of the "DECISION" is really ours, we people in this meeting, to influence our respective managements to retain an old building and recycle it into a modern railroad facility.

In certain instances there may be many basic advantages in these older structures—like old oil paintings—there often seems so much more substance than in modern art. Sometimes it really is possible to "make a silk purse out of a sow's ear". Many times these older buildings are so well located. It was indeed a very wise old real estate agent who first listed the three most important assets of any building or property; namely, the first is location; the second is location; and the third—you guessed it—location.

I would assume from my study of previous *Annual Proceedings*, that you are expecting technical data, energy calculations, financial graphs, or other academic bases to back up a report of this type. Ladies and Gentlemen, my charge to you today is: How does the building under consideration fit into future railroad use? The technical data, engineering, architecture, and cost studies all, of course, must eventually be evaluated, and will certainly vary with every building. Each of these topics could, of themselves, be the subject of a study on recycling.

However, since many of us are sometimes daily, or at least weekly, involved with our top managements in the evaluation of one building or another, this word "DECISION" covers one of our most perplexing problems, speaking not only philosophically, but from a very practical stand point.

The assembling of information to accomplish the construction itself is sometimes easier than the initial "DECISION" to move forward with the project in the first place. Often, because of indecision, many of us have passed up construction during warm and dry summer months, then end up having to build during inclement weather in the fall or winter. A prompt and judicious decision "to do" or "not do" a recycling project often eliminates costly redesign time and the incessant re-analysis of the project economics.

FIGURE 1—a favorably located, old, but well-constructed warehouse.

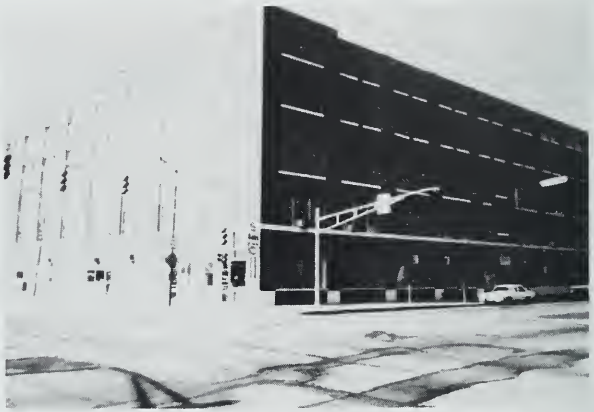


FIGURE 2—After modernization and change in use, an adaptable and efficient regional headquarters.

FIGURE 3—Before, an obsolete deteriorated drafty old maintenance shop.

FIGURE 4—AFTER, a modernized, economical and efficient locomotive maintenance facility.

FIGURE 5—A catch-all storage area.

FIGURE 6—Using three existing walls, the area becomes a modern fan motor shop.

An early "DECISION" allows for proper planning time, more efficient use of engineering and administrative personnel, and generally the best selection of the period of time that the physical work would be performed.

Suppose we were to list the reasons that bring into being the need to consider recycling projects. We could call it "RECYCLING OLD BUILDINGS—THE WHYS AND WHEREFORES".

I have found the following reasons to be the most compelling ones. You may have others.

Neglect

As mentioned before, despite very limited maintenance budgets, we should consider if, in many cases, it is not shortsighted to allow structures of great capital value to become abandoned and vandalized ruins (sometimes to the point of incurring municipal code violations) for want of an occasional "lick and a promise" amount of care.

Granted, there is something non-glamourous, or seemingly unnecessary about fixing a few patches on the roof, or painting the window sills before they rot out, or other minor items of just plain preservation of the investment.

It must be fairly obvious that a goodly percentage of the need to recycle originated with deferred maintenance. Many of our so-called "Old Buildings" became known as such, not so much from being worn out, as from neglect.

Change in Operations

This, of course, is a textbook reason or justification to recycle. For example, perhaps there is a former steam engine roundhouse, in salvageable conditions, that is still favorably located for use as a diesel facility. It is obvious that studies may reveal that it would be a wise capital investment to recycle the older steam facility.

Or possibly there is a warehouse which, while structurally sound, has outlived its usefulness for the orginally designed purpose. Such a structure may often show a favorable return on investment by converting it to office or other use, even after considerable expense of recycling.

We have several illustrations of such changes in building use in our slide presentation.

Obsolescence

This too, is a most common category. A car shop, engine terminal building, or other facility may be marginally adequate for its present function. It may be lacking in modern and efficient lighting, heating, ventilating, and cooling. It might be a very inefficient facility and under consideration for removal from the property.

Such a shop could be a prime candidate for extensive recycling, to include siding, roof, complete insulation, and interior work. We have slides of an excellent illustration of such work done on a large car shop in Wilmington, Delaware.

Upgrading

While very similar to recycling due to obsolescence, there are certain other very recognizable considerations. Many office facilities have not had a face lifting since Day 1. Possibly consideration has been given to moving into a modern structure, but the employees are functioning adequately in the present building.

Here, then, is a candidate for recycling, or extensive upgrading, the payoff being in improved morale, conservation of energy (both heating and electricity), and a general increase in employee efficiency.

A greater space utilization of the facility can often be accomplished by the concept of "Open Space Planning" during the upgrading, a possible advantage that should not be overlooked in our recommendations to management when they have under consideration the "DECISION" to recycle.

Adaptive Reuse

This fancy term, in the parlance of the real estate entrepreneurs and financial brokerage institutions, is what would generally be termed either large scale or total renovation. The property is usually altered to serve or adapt to a different basic purpose or use; therein the term "adaptive reuse". While there are many notable examples on the national scene, perhaps, due to the age factor alone, the probability is somewhat greater in

the industrial Northeast and Midwest for such "adaptive reuse" projects such as:

a. Conversion of a former factory or other industrial facility into apartments and offices, often to include public shops and commercial establishments.
b. Redevelopment of private (or public) waterfront pier facilities into more people-oriented use such as condominiums for living space, and places of assembly such as small theatres for cultural activities.
c. Reutilization of big, old "white elephant" type structures, such as passenger train stations, bus depots, baggage terminals, etc.

These "adaptive reuse" projects offer certain immediate real financial advantages when the decisions for such capital investments are made, namely:

a. Investment for tax credits, particularly for buildings with the status of "Nationally Registered Historic Landmarks", an outstanding example of such being Grand Central Terminal in New York City.
b. Considerably shorter depreciation periods for the improvements.
c. Reconstruction costs which often are not over 50% of comparable new construction.
d. Service roads, sidewalks, and utilities are often in place and quite adequate.
e. The most important of all considerations could be the availability of public and quasi-public funds, should the property qualify for an urban improvement authority. Such projects often benefit from the conveyance to some form of a public authority ownership, with incident up-front construction funds, tax relief, and general public support or sponsorship for their ongoing success.

Our slides taken at Chattanooga, Tennessee and Utica, New York will show two fine examples of station renovations, and are illustrative of "Recycling Old Railroad Buildings".

Granted, while the decisions for these large scale redevelopment projects are mostly made at the higher levels of our railroad real estate, finance, and law management offices, we architectural and engineering personnel often have certain basic initial input toward those ultimate decisions. With these introductory thoughts, we will proceed to the slide presentation of certain recycled buildings as offered by Members of Committee 2.

Indianapolis, Indiana
A Regional Headquarters Building

About fifteen years ago this railroad, due to a major re-organization, had an influx of employees into Indianapolis, resulting in the need for approximately 115,000 sq. ft. of office space to accomodate a regional and two division offices, along with certain system personnel and a computer facility.

After considering several center city office buildings, the decision was made to purchase a five story, 245 ft. x 195 ft. concrete frame (with brick walls) warehouse building to convert into offices. Adjoining the warehouse was an eight-story cold storage facility which had to be included in the purchase. The warehouse is in close proximity to the main tracks, and had a delivery side track into the building. Although forty-five years old at the time, it was exceptionally well constructed, having been designed for a 150 lb. per sq. ft. floor load.

While the railroad required only the top three floors for offices, the first two floors were leased out and gave a rental income, which further justified the purchase. The cold storage facility was removed giving space for an eighty-car private parking lot, a very real advantage for this operational headquarters.

Although a major project of interior work, the architectural and engineering design was fairly straightforward since the floors were essentially bare office space.

The larger items of work were as follows:

a. Replace windows on the top two floors.
b. Replace two passenger elevators.
c. Replace all heating (including the distribution system).
d. Install a new primary electric system, including secondary distribution.
e. Install an above ceiling HVAC system, with three 80-ton cold water generators on the roof.
f. Install a hung ceiling with lay-in light fixtures.

g. The floor covering is primarily vinyl-asbestos, with carpeting where warranted.
h. Office partitions were essentially free standing space dividers (Hauserman Redi-Wall), with dry-wall where required.
i. Complete new toilet facilities on the railroad-occupied floors.
j. Pointing, caulking, and re-decorating.

This facility has been serving well for its intended use. It was a financially sound investment, considering the escalated costs for rental space since its purchase, and has been efficient and well received office space for the employees.

Davenport, Iowa Roundhouse

A roundhouse in the Davenport, Iowa area had been neglected for years because it was not required in the railroad's long range plan. A few years ago, the railroad's operation changed and the reuse of this facility became necessary.

A thorough inspection of the 15-stall building was made, and it was determined to be structurally sound, except for the last 2 stalls which were not economical to repair and were removed.

A new insulated metal end wall was constructed. Most of the remaining wood windows, being in poor condition, were covered over with insulated metal siding. Where natural light was desirable, new windows were provided.

New plywood roof sheathing and built-up roofing were installed. Inside, a few wood purlins and several wood corbel blocks were replaced. The trusses and masonry walls were found to be in reasonably good condition. However, the masonry will need pointing in the near future. The wood engine house doors were repaired and covered with metal siding.

Inside, the old lighting was a combination of incandescent and self-ballasted mercury fixtures. Heating was minimal, except for a few infra-red units previously used for thawing locomotives.

New high pressure sodium light fixtures, along with gas fired unit heaters, were added throughout the building.

The interior walls were sandblasted and the floors cleaned. Support equipment and machinery were reinstalled for a more efficient operation.

The new offices have air-conditioning, fluorescent lighting, and sound-deadening insulation in the walls and ceiling. The working environment for the employees has been considerably improved.

South Altoona, Pa Material Distribution Center

This present warehouse facility, built in 1903 for use in steam engine days as a wheel and brass foundry, has approximately 113,000 sq. ft. of floor area under roof (602 ft. x 188 ft.) and is 22 ft. to the eave line, with a variety of high and low bays.

Over the years, the requirements for the foundry products diminished and eventually vanished due to procurement of wheels, bearings, etc. from other sources, and after the need for steam engine parts had long gone.

As the foundry operations shrank, the building space became used more and more for warehouse activities, so that in the recent several years the railroad decided to convert the entire facility, including the supporting rail yard and delivery tracks, to a major system material storage center.

The interior space was cleared of obsolete foundry facilities and more area made available for rack, palletized, and solid pile storage of material.

Major items of work on the building were as follows:

a. Considerable replacement of roofing.
b. The filling in of approximately 13,000 sq. ft. of window openings (many 12 ft. or 18 ft wide x 20 ft. high) with insulated concrete blocks. The blocks replaced Filon covered wood sash to eliminate a fire risk, and gave a substantial benefit in fuel savings.
c. The installation of a sprinkler system throughout the storage area, fully monitored to the railroad's local 24-hour police headquarters.
d. Replacement of the heat distribution system as required.
e. A 4" concrete topping over the existing old floor to allow for safe and efficient operation of fork lift trucks.

f. Since the area is somewhat isolated and security was of concern, extensive fencing, along with intrusion detection, was installed.

This facility has been serving very well in supporting the railroad's maintenance activities, with lower operating costs, reduced inventory of material, better control, and most importantly, a more responsive support of material needs.

Milwaukee, Wisconsin Crew Headquarters

One of our railroads acquired a motel of somewhat bad reputation and worse construction, but at a very good price. The idea was to provide lodging for train crews. Once having seen the facility, the Engineer of Buildings strongly recommended against the purchase at any price, so the railroad immediately snapped it up.

The steel joists are so undersized that there is a pronounced and permanent deflection across the building. When walking across some of the longer spans, one gets the feeling of being on a trampoline. Cracked concrete and a reverse slope on the decks added to the building's structural deficiencies. When it rains, water hitting the deck flows under the doors and into the rooms instead of off the edge of the deck.

Now consider the second group of problems. A beam supports the bar joists which, although sway-backed, carry the deck. A gap is exposed to the elements, between the beam and the deck. The solution was to wedge in a piece of wood as a nailer, then nail a piece of wood over the gap. (Redwood was shrewdly used by the former owners, with plenty of caulking). Then some boards were nailed in front so it can't be seen or reached. This ingenious detail might have remained water tight for as long as two or three years—under static conditions. If the amount of rust and corrosion inside is any indication, the seals failed almost immediately under the spring-like movement of the deck.

The bar joists were heavily rusted and the steel deck under the concrete completely corroded and flaking off as far back as a foot from the edge, leaving only the thin concrete to hold things up. Water regularly discolors and spalls off the plaster firestop over the garage.

Venting is excellent—four or five inches of daylight on one side. It's almost as if they anticipated the moisture problem: if water could get in, then so could the air to dry things out. But the garage had an outstanding example of good ceiling insulation. The only question is, why insulate the ceiling of the garage space? After all, it has no walls. It goes without saying that there is no insulation at all between the floors of the heated spaces above and the cold air, which has led to some choice comments from the train crews about the bathroom floors after a shower.

There was an ambitious attempt to ameliorate these situations prior to the railroad buying the building. A barrier was built to keep the rain off the decks, using corrugated fiberglass set in vertical louvers. The barrier did not work and the thru-wall air conditioning units dripped their condensate onto the deck, thereby creating a further water problem.

Another attempt was made. This involved constructing dams across the doors. This worked. The water just sat on the decks until it evaporated or seeped in somewhere. A solution to these problems involved concrete work, deck work along the edge, and balcony work.

It was decided to slope the decks in the conventional manner, away from the building, utilizing epoxy-concrete. This state-of-the-art product had to meet two difficult requirements. First, the new surface would have to bond durably to the old concrete even when very thin along the edges; second, the new surface would have to withstand stresses due to the deck's "springy" structure.

The waterdams at the doors were a dense, strong, closed cell gasket strip bonded to the concrete which compressed when the door was closed, forming a watertight–airtight seal. Also, a drip cap was added to the bottom of the door. The introduction of a good drainage scheme eliminated the need for this "barrier" concept entirely, and also solved the air-conditioner condensate problem.

Another item of work consisted of sealing the edge of the deck with steel plates welded along three sides. The fourth side extends beyond the flange of the beam to provide a drip and a little ventilation. Prior to placing the steel plates, the existing rusty members

were wire brushed and the metal primed. The new spandrel assembly was then sealed with an appropriate epoxy compound.

Treated ponderosa pine was used on the balcony to replace the barrier. The initial study ignored the gable and extended the railing around the building. This did not look well, it being apparent that a good solution would have to visually acknowledge the presence of the gable, so what was created is a large post-modern arch.

The railroad then did one more thing. Remembering what Winston Churchill said about architecture "Man has one chance to shape his buildings—thereafter they shape him", they decided to make flower boxes part of the design. This was actually well received in certain quarters. In others, they got the reaction expected. The issue is still in doubt, but the train crews may yet wake up in the morning to fragrant and colorful displays of pansies, petunias, vinca vines, and other beer-tolerant species. The staff psychologist is anxious to study the reactions and effects on the train crews.

Wilmington, Delaware
Rehabilitation of Locomotive Shop

This shop building serves as the maintenance and overhaul facility for all electric locomotives and many cars used in passenger service in the Northeast. Its uninterrupted operation is essential to the maintenance of that service.

Built around 1907, the building was used for over 70 years without major modifications. Large windows and skylights, originally needed for adequate lighting, were both obsolete for that purpose and had been allowed to deteriorate, in some cases to the point of collapse. Brick walls had become permeated with water from leaking roofs and broken roof drains, and, if left unattended, would have become unstable through continued freeze/thaw exposure. Heat loss through broken or missing windows and skylights resulted in heating costs estimated at a half million dollars a year.

In order to keep the shop in service, and preserve it for continued use in the future, an entirely new building envelope was provided around the existing structure, using insulated metal roofing and siding systems.

Existing windows were removed, and masonry jams and sills rebuilt to receive new work. Steel girts were installed across the openings, flush with the face of brick pilasters. Pre-painted interior liner panels were installed to form the new interior walls. Glass fiber insulation, four inches thick, and pre-finished galvanized exterior siding was placed over the entire exterior surface of the walls. New overhead coiling and required personnel doors were installed.

The existing roofing, roof deck, and skylights were removed. A roofing system utilizing 6″ glass fiber insulation, pre-finished interior liner panels, and galvanized roofing panels was installed. New gutters, downspouts, and lighting were included.

Completed at a cost of approximately two million dollars, the renovation has reduced annual heating costs in excess of $400,000.00. Additional savings are expected through improved employee efficiency and morale. The materials utilized are expected to give thirty years service with minimal maintenance.

Olewein, Iowa
Backshop Rehabilitation

Metal wall and roof panels were used to modernize a backshop that had become obsolete in Oelwein, Iowa.

Broken windows were removed and replaced with concrete block. Horizontal steel girts were used to fasten top panels over the original steel frame portion of the building. Bottom panels were then added to complete the wall panel section.

A new roof was constructed over the existing tongue and groove planks. Pointing and additional brick were added at the gable to allow the placing of an end fascia panel. A vapor barrier and insulation were installed under the metal roof panels to complete the roofing section.

Indianapolis, Indiana
Rehabilitation of System Car Shop

A car shop near Indianapolis was neglected for many years. Through a change of ownership, this complex, including seven major buildings, became the primary car overhaul facility for its new owner.

Masonry pilasters and spandrel panels were repaired and left exposed. Windows were removed and replaced with factory-laminated wall panels consisting of interior liner sheets, foam insulation, and finished exterior sheets. Operable window sash with double-layer insulating polycarbonate glazing provide ventilation. Fiber-reinforced resin glazing was used in the upper window openings. On sloping roofs, new fiber glass insulation blankets and roof panels were installed over the existing roof purlins. Flat roofs were re-roofed using conventional built-up roofing.

The program was carried out over three years. After the first year's work was completed, heating losses were reduced to the point that only one of the two central boilers was required to heat this car shop.

Oak Island, New Jersey
Rehabilitation and Modernization of an Engine House

This building has a floor area of 200′ x 70′ encompassing a repair shop with offices, storage areas, and employee welfare facilities. The facility was built about 1920 as a repair shop for steam engines and was essentially abandoned in 1976.

In 1981 the decision was made to reactivate and upgrade the existing building by the following improvements:

New doors, frames and windows, along with two coats of exterior masonry paint, did wonders to seal the building as well as enhance its appearance.

New lunch and locker rooms, as well as lavatory facilities, were added in the west-wing.

The window panels were replaced with centerscored blockpanels and small aluminum hopper windows. Through the use of epoxy and cement plaster the deteriorated lintels were fully restored.

An old exterior sliding door was replaced with a new overhead roll-up door. Required exit lights were added, which further accented the new block panel work.

The two updated inspection pits within the shop area were furnished with new lights, new air and lube lines, as well as cab signal test facilities. The use of bright yellow paint lines accents the emphasis on safety.

The workshop area received gas-fired spaceheaters with reflector shields directing the heat downwards.

A new wash platform for engines was built along the south side of the building. The effluents are being collected in an underground holding tank from which they are pumped to an oil-water separator system located in the northwest section of the building.

Through the combined efforts of company design and construction departments and a reputable contractor, an old shell of a building became a useful, attractive, and cost efficient modern facility.

Chattanooga, Tennessee
The Terminal Station

An 85-foot dome of riveted steel, combined with a 60-foot brick arch, were the outstanding features of a railroad terminal design by Donn Barber which won first prize in the Paris Beau Arts Competition of 1900. This design was chosen for a new terminal in Chattanooga, which was built during the years 1906 to 1909. After serving as a busy railroad center for sixty-four years, the last train pulled out of this terminal in August, 1970. The buildings were boarded up and the property was advertised for sale and possible demolition. In 1971 a group of twenty-four Chattanooga citizens formed "The Quiet Company" and bought the Terminal and all support buildings.

After two years of planning and construction, the refurbished buildings and grounds emerged as "The Chattanooga Choo-Choo". The Chattanooga Choo-Choo's "Grand Dome" dining room, which seats 350 persons, is thought to be the world's highest free standing dome. It is made entirely of steel and concrete and is securely braced by red brick arches. Rising an awesome 85 feet from the floor of the former main lobby, the dome had been hidden from the traveler's view since 1961 by a hung ceiling of standard height, installed to cut heating costs. Now the rich gold and soft yellow hues that outline the sweeping arches and girders bring

back the original impression of massive beauty in the Victorian tradition.

The concourse area, open-air in the old days, has been glazed and transformed by latticework into the Palm Terrace Restaurant, which seats 550 diners. The outdoor effect is enhanced by lavish use of potted palms, a 40 foot long waterfall covering one wall, and gazebos which double as serving stations.

One of the smaller rooms adjacent to the grand dome was transformed into the "Victorian Saloon". The express depot was turned into the "Station House" night club. Mail rooms, freight buildings, repair shops, machine rooms, and storage lofts were turned into a theater, an art gallery and a shopping concourse.

Outdoors, several tracks gave way to construction of formal gardens, complete with statues and fountains collected from around the world. Designed and maintained by botanical specialists, each plant was handpicked from botanical suppliers in the United States and Mexico.

Adjacent to the formal gardens, the tracks were left in place so as to park 24 sleeping cars, each converted into two rooms. Brass beds, plush upholstery, and red and black carpets afford an overnight plunge into another era, made easier, of course, by such modern touches as air conditioning, color television, and full bathrooms.

The complex has become so large that two old New Orleans trolleys are used to transport visitors between parking, restaurants, hotel, and convention center.

The original Chattanooga Choo-Choo consisted of the 1,300 seat restaurant, with a few shops located in the old Terminal Building, and a 150-room hotel. Using the Terminal Station as a backbone for the project, the Chattanooga Choo-Choo, in only ten years, has grown into a 24 acre restaurant, hotel, convention, shopping and entertainment complex. Today it boasts of having not only one of the largest restaurants in the world, but also a hotel with over 400 rooms, 48 of which are in railroad sleeping cars.

With a little imagination and creativity this useless, boarded-up, forgotten relic of the past, scheduled for demolition, has been transformed into a wonderful complex which attracts about two million visitors every year.

Utica, New York Union Station

This very handsome Union Station building, built in 1914 as an architectural and functional masterpiece, was considered illustrative of the best of the state-of-the-art at the time, as evidenced by its placement on The National Register of Historic Places in 1977. In addition to its passenger facilities, the building originally served as the railroad's headquarters for a region and two operating divisions. This three (and partially four) story structure, of steel and masonry, approximately 204 ft. by 192 ft., and 70 ft. in height, contains nearly 90,000 sq. ft. of floor area.

During the 1960's the upper floors became essentially vacant, and, because of disuse and no particular need for attention, deteriorated over the years. While being much too large a facility for present or any forseeable needs, the owning railroad had to absorb ever increasing expenses for utilities, taxes, and maintenance.

Through the combined efforts of a preservation group consisting of local business interests, the City of Utica, Oneida County, the State of New York, and the railroad, work was begun in 1977 to restore this edifice to its former ambience and splendor.

Professional appraisals indicated the building to have a financial value of zero, but the highest and best use was to continue its present use as a transportation terminal, after renovation.

An interesting arrangement evolved wherein the Oneida County Industrial Development Agency (IDA), a tax exempt entity, purchased the property from the Railroad for a dollar, whereupon the railroad and Oneida County leased it back from the IDA for a dollar for twenty years, plus two ten year options. Title to the building was transferred to the IDA in order to expend public funds on building renovation and restoration, and to keep jobs in the area.

The IDA's leaseback to the County passed on the obligation of basic building repair and restoration to the County, and to date, the County has spent about 1.5 million dollars.

Any further work on the station will require additional public or private funding.

The IDA's leaseback to the railroad passed on the obligation for maintenance and operating costs to the railroad, following renovation, which costs can hopefully be alleviated by tenant participation in these expenses.

When the full restoration work is accomplished and the building occupied by passenger agencies, a restaurant, and other commercial leases, the railroad will have significantly helped itself and the community out of what was a stressful situation.

The visions of Union Station again becoming strikingly attractive and an asset to the community are in the process of being realized.

Altoona, Pa
A Fan Motor Shop

For a period of time this railroad maintained two heavy locomotive repair shops, one for GE locomotives, and one for EMD locomotives. Several years ago management decided that the work could be consolidated into one expanded facility, providing enlargement of certain shops was accomplished. One of those requirements was an enlarged fan motor shop, preferably as close to the main locomotive erecting shop as possible. The only open space remaining in the congested maze of shop buildings was approximately 19000 sq. ft. of outside storage area, between two existing old shop buildings 72 ft. apart.

It was decided to roof over this area, utilizing the side walls of the existing two shop buildings, with one end against the newly expanded erecting shop; thus only one new (end) wall was required.

While consideration was given to bearing the new roof load on the very substantial steel columns in the old adjacent building walls, prudence of design dictated new roof support columns set on new caisson foundations.

As shown in the slide presentation, a very fine 19000 sq. ft. fan motor shop was thusly created, with travelling cranes, an electronics work room, offices, and other facilities, from what was otherwise a catch-all storage area.

While the use of the existing three walls gave certain good savings, the real advantage was the ideal location of the facility as built.

Conclusion

I would like to acknowledge the fine support given by the Members of Committee 2 and, also to John Kapp and Paul Saletnik, who, on their own, volunteered such friendly, and certainly appreciated, assistance.

I now trust that, for as many years as you care to remember, when faced with an older building to recycle, be it a railroad structure or a corn crib on your retirement farm, you will, with a smile on your countenance, fondly remember Committee 2's meeting on DECISIONS, DECISIONS, DECISIONS. They may not be entirely yours, but you can *influence* them.
THANK YOU.

President Denz: Thank you Mr. Saletnik and Mr. Campbell for your presentation. We certainly enjoyed it. I am familiar with the possibility of difficulties which would arise in the preparation of such a report.

We have now reached the point where, if there are no special announcements, we will adjourn. Be sure to meet with your friends tonight and enjoy the dinner and entertainment to be provided by REMSA at the banquet. Meeting is adjourned until the joint session at 8:30 a.m. tomorrow.

WEDNESDAY MORNING

September 14, 1983

The Wednesday Morning Joint Session was called to order at 8:45 A.M.

President Denz: I hereby call this Joint Session of our Conference to order. Good morning, everybody. I hope you all enjoyed the REMSA Banquet and entertainment as much as I did last night.

First off this morning I will turn the rostrum over to President Hernandez.

President Hernandez: Good morning. This is the time where, as we say on the railroad, I can see the light at the end of the tunnel. As we approach the closing of our Centennial Conference I wish to express my personal thanks and appreciation to the 1983 Executive Board of the Roadmasters and Maintenance of Way Association of America and to all the committee chairmen and their committes, to President Denz and the entire American Railway Bridge and Building Association Board for their cooperation. Special thanks to our Conference Chairman, Mike Marlow, who, despite adversity, organized this conference, and to Pat Weissmann, and her able assistant Joyce Grier for a job well done; to our Ladies' man, Mr. Ray Snyder, who did such a wonderful job to the extent that most of the ladies were very happy; to my wife Isabel for her continued support and understanding; to Karl Sutherland, the Past President, who has been so dedicated and involved with our organization this past year; and last but not least to Mr. Joe Bush, President, and the entire REMSA Board for an excellent Banquet which we enjoyed very much, and individually to the REMSA membership whose hospitality rooms were very much appreciated.

At this time I wish to express my personal appreciation and on behalf of the Association I wish to thank the outgoing Board Members who have completed their term of office and who have contributed so much to the business of this Association. Will you please come forward as I call your name.

Mr. T. R. Rosamond. Tom, on behalf of the Association, I wish to present this Appreciation Award which reads: "Presented by the Roadmasters and Maintenance of Way Association of America to T. R. Rosamond for his service as Director from 1979 to 1982."

Thank you very much for all your help, Tom.

Mr. Rosamond: Thank you, Ray.

President Hernandez: Mr. J. J. Swiderski.

Karl, will you come up and accept this on behalf of Mr. Swiderski.

Mr. D. E. Staplin.

Mr. C. W. Moorman.

At this time I will turn the rostrum over to Mr. Denz to continue with the program. Thank you.

President Denz: First off this morning we will get into high gear and have a Report from our Standing Committee on Equipment. I will call upon Mr. R. A. Tallent to introduce the speaker.

Mr. Tallent: Gentlemen, we have a report this morning on High Pressure Water Jetting as used in cleaning culverts and various other cleaning processes we have a need for on the railroad. This slide presentation will be made by Mr. Nick Woodhead. Nick is Vice President of Harben, Incorporated and has been in the high pressure water jetting business since 1972. He joined Harben System in 1976, came to the United States in 1979, and helped form Harben, Incorporated in May of 1981. Nick is responsible for U.S. sales and the running of the main Harben manufacturing facility at Cummins, Georgia. Nick Woodhead.

High Pressure Water and the Rail Industry

By Nick Woodhead

Vice President, Harben, Incorporated

My first contact with any rail industry was in 1976 with a British Rail maintenance facility in London.

History

Having joined Harben at the beginning of that year, I was interested to see what use British Rail made of the equipment. They had two of our 3006 ES units. These were electric skid mounted units delivering 3,000 psi at 6 gallons per minute. In this particular facility, the locomotives were brought in and their housings removed exposing the running gear which could then be effectively cleaned. The locomotives were routinely cleaned to prevent a build up of oil and debris which were potential fire hazards. This also made them much easier to work on. Since then, most British Rail maintenance facilities have installed Harben equipment.

Harben was started in 1971 and from humble beginnings, when the first Harben Pump was designed and hand-made in the garage of our designer, it has expanded to a point where units are now being sold in many countries around the world. There have been several changes, but the basic design is still the same.

The Harben Pump has several design advantages over conventional plunger pumps. In brief, it is a radial piston diaphragm design where the water is isolated from the moving parts by tubular rubber diaphragms. All the moving parts run in an oil bath, and, consequently, the Harben can run dry without damage. Major problem areas with conventional plunger pumps, which are piston seals and packings, are completely eliminated from the design.

Although the Harben Pump has been available in the United States for several years, it was in 1981 that Harben Inc. was formed to manufacture and market the range of Harben high pressure water jetting equipment.

High pressure water has many uses, mainly related to cleaning, but we are even using it for water hydraulics and such applications as the high speed transportation of pulverised fuel ash.

Locomotive Cleaning

My first contact with a United States railroad operation was through our dealer in Pennsylvania, with Conrail in Philadelphia. A meeting was set up with Conrail, and we discussed all aspects of high pressure water cleaning. One of Conrail's main interests was to reduce the amount of chemicals used in cleaning locomotives, as it was getting to the stage where the disposal of the used cleaning chemicals was becoming a problem. To this point, their method of locomotive cleaning was to spray a degreaser on the locomotives and rinse them with low pressure water. This method entailed using several applications of chemicals. Our suggestion was, to remove the bulk of the material with a high pressure water jet at 3,000 to 4,000 pounds per square inch, and then, if necessary, make a final clean with a very small quantity of detergent. Trials were set up at the Conrail Harrisburg facility, and we took a HARBEN 4010 DTL (A 4,000 pounds per square inch, 10 gallons per minute diesel powered machine). The tests proved successful, and we even cleared a blocked drain while we were there. We also

demonstrated the Harben Hoverclean Floor Scrubber. Within a few months, an electric powered cart-mounted Harben was purchased and put into the Bethlehem maintenance facility. This unit produced controllable pressure up to 4,000 psi at 9.5 gpm.

Culvert Cleaning

Some time later, I received a call from the Norfolk Southern Group who somehow had received a brochure on our equipment and were, at the time, considering a high pressure jetting unit for cleaning culverts under the tracks. One of our specialties has been in designing equipment for sewer and drain cleaning, so when this inquiry came through, we were in an area where we had a lot of expertise.

Our philosophy has always been to make as little water do as much work as possible and although this Group had been using a contractor with a 1,800 pounds per square inch 60 gallons per minute pump, they were intrigued by the design of our equipment and our idea of reducing the amount of water used and increasing the pressure to get the desired results. The fact that the Harben Pump could also run twice as long on the same amount of water without the need for filling up, was an added feature.

One of the major problems with using large quantities of water is the fact that you have got to have a readily available supply, and culverts are, unfortunately, not always placed near a readily available water supply.

The size of culverts that needed to be cleaned were from 24 inches to 48 inches in diameter, and these could be either concrete cylindrical pipes, square section concrete pipes, or some very old square section pipes. The material in the pipes could vary from mud to rock, sand, gravel, or roots.

Not only was the unit to be used for culvert cleaning, but the Group also wanted it to be able to water sandblast with it for paint removal on bridges, and jetting, using a hand-held gun, for general purpose cleaning.

Our recommendation was a Harben Century Series Unit which could produce 3,000 pounds per square inch at 37 gallons per minute, for culvert cleaning, and also, by changing the nozzle, go up to maximum of 6,000 pounds per square inch for water sandblasting, paint removal, and surface preparation. This versatility was of great interest to the Norfolk Southern Group, as it offered a multi functional unit in one package.

Demonstrations were held at the Harben factory just outside Atlanta, and the first unit was supplied in January 1983. This consisted of a Ford truck with a 1,000 gallon water tank and a Harben Century Pump powered by a Deutz air cooled diesel engine with a hydraulically powered reel that would swing through 270 degrees. The truck was fitted for hy-rail operation. It was supplied with 500 feet of high pressure hose, various pipe cleaning nozzles, a hand held gun, sand-blast attachment and a jet pump for filling the tank from a stream or pond.

The first job it was sent to consisted of a 36 inch culvert that had become completely blocked and formed a fairly large lake behind it. After jetting the pipe for about 30 minutes, the blockages gave way and a solid wall of water emerged from the pipe.

As a foot-note: if that culvert had not been unblocked, it would not have been long before the whole section of track would have been washed out and considerable expense incurred. In fact, I have been informed that the unit paid for itself within the first two weeks of operation.

Other areas of application for high pressure cleaning are: workshop floor areas—which can be hazardous to personnel when greasy. These can be cleaned with our Hoverclean Jet Scrubber, providing there is reasonable drainage; bridge cleaning which includes water sandblasting and expansion joint cleaning; internal and external tank car cleaning; spraying herbicides; descaling rails as they come out of the rolling mills.

Mr. Meek: When you are out cleaning culverts are you able to pump water out of the river, or do you have to have clean water?

Mr. Woodhead: We have a venturi jet pump which will actually fill the water tank on the unit, so you can attach that to the high pressure hose and fill up your tank. As long

as you don't run out of water completely you can then use that to fill your tanks; yes.

Mr. Meek: Can you use dirty water?

Mr. Woodhead: The cleaner the water you can use the longer your valves will last in the pump. We have two filtration systems on the unit, so we do use reasonably dirty water, but obviously the cleaner the water the better it is. It is just a numbers game. If you use very dirty water your valves are going to wear out faster.

Karl Sutherland (CPR): Have you ever given any thought to putting a steam jenny on this for thawing frozen culverts?

Mr. Woodhead: We have, yes, but we don't need to put the steam jenny on. We just use the high pressure water alone and it will do it. We have had considerable experience with contractors, people like Roto Rooter, who use our equipment in cold climates to thaw frozen pipes.

Mr. Sutherland: I think that should be a real asset for winter operation.

Mr. Woodhead: Yes. You could also run an antifreeze system in the water, which would help thaw it as well and keep it thawed.

Mr. Sutherland: Has it actually been tried in thawing culverts?

Mr. Woodhead: I don't know about culverts, but it has certainly been done in pipes, yes.

Mr. Sutherland: In the Northern parts of the country we have not so much a problem with dirt and debris, but we have a lot of ice in those culverts, and of course with all the steam generators going away now we have a problem thawing culverts.

Mr. Woodhead: Well, at reasonably high pressures, three or four thousand pound per square inch, yes, we will cut out ice and dethaw it, very rapidly, too.

Any more questions?

Mr. Durant (UP): How would it work on ice jams? Have you tried it on any ice jams against bridges—for breaking up ice jams?

Mr. Woodhead: No, but I am sure it would work.

Mr. Durant: And how about removing grease from concrete?

Mr. Woodhead: Yes, it will remove grease from concrete. I have performed some demonstrations on fuel tanks and engines, and some people said, "Oh, you really need hot water to get that final film off." We have put a little bit of detergent either in the water stream or we spray it on the engine first of all, and that removes the dirt completely, and you can get all the oil off, including that final film.

Member: How much does that unit cost?

Mr. Woodhead: The high pressure pump package, the water tank and the diesel engine to power it was around $40,000. That didn't include the truck, though. It was about $80,000 total. But I understand it paid for itself on the first job.

Member: What about asbestos coating on corrugated metal pipe?

Mr. Woodhead: I know in England they have a lot of passenger cars which have asbestos in them, and they use high pressure water to cut the asbestos out.

Member: Well, when they have put the coating on to protect steel pipe, will the high pressure water take that off?

Mr. Woodhead: That depends on what nozzle you have on. If you have got a zero degree tip, as I call it, yes, it will; it will cut a lot of material. If you put a fan jet on and clean around it, you shouldn't damage the coating. The pressure can be completely controlled. You know, we talk of high pressures but you have a throttle which will control the pressure, and on our particular pump you have a pressure flow variation simply by changing the nozzle. For instance, on the culvert cleaner you saw there at the top end, it is working at 6,000 pounds per square inch at about 30 gallons per minute, at the lower end it is about 2,000 pounds per square inch and it is up to nearly 40 gallons a minute, and you can control that simply by changing the nozzle.

Now you could run three or four guns. If you were cleaning a bridge, for instance, and you wanted four or five people to be working, you could run three or four guns off of that one unit. We can put chokes in the guns, so that when one guy lets go of the trigger it doesn't take all of the water from the other guns. Our guns are double barrel safety guns. As soon as you release the trigger you get a flow of low pressure water

out of one of the barrels, squeeze the trigger and you get high pressure water. Both act as a relief valve on the pump.

Member: What are the safety aspects? Say you are working three guys together.

Mr. Woodhead: When we sell a machine we give full training. That high pressure water is dangerous. Any machine, if it is used improperly, is dangerous. If you buy a lawnmower and stick your foot under the hood you are going to cut your toes off. You will do it a lot faster with high pressure water. It is dangerous if it is used in the wrong hands. We feel we give good instructions and good safety training to everybody who buys them. We have probably some six thousand machines around the world, and as such I can only think of two or three accidents, and those have all been through carelessness. The hoses we use are all on a three to one safety factor. There is an automatic blowoff on the pump which should go off if you overpressurize the system.

The other thing is if your men watch the system. If you have a hose that has cuts in it, and it is looking worn, then it is sensible to change it, not to wait until it gives out.

Any other questions?

Member: I would like to ask Ray a question. Is this applicable to cleaning ballast off of bridge shoes?

Mr. Tallent: With this hand gun we have the option of varying the pressure up to 6,000. You have got a wide nozzle that you can put on there, and it will clean bridge shoes. If you have a lot of stuff piled up it will take a little longer time to clean it off, but it will clean them.

Member: That $80,000, does that include the hy-rail?

Mr. Tallent: Yes, including the hy-rail. It is a total package.

Mr. Woodhead: Thank you very much. (Applause)

President Denz: Thank you, Mr. Tallent and Mr. Woodhead.

Now I call upon Mr. Jim Davidson to introduce the next speaker. Jim.

Mr. Davidson: Our next talk on equipment relates to some equipment used for bridge inspection. In the past it was generally true that the best inspection you ever got on a bridge was when painters swung their scaffolding and you could get to areas you could never get to before. Unfortunately, with the increasing trend toward use of high strength weathering steel and even the tendency to stretch out maintenance painting schedules on conventional steel, you don't get the inspection of those inaccessible areas that you used to be able to get. Consequently, some additional equipment has been developed fairly recently, and this will be described by our next speaker, Mr. Jim Gustafson.

Jim began working for the Northern Pacific Railroad in the Bridge Department in 1953. He progressed through various positions, and with the merger into Burlington Northern he became Bridge Engineer Standards BN and is now Bridge Engineer for the Twin City Region based in St. Paul, Minnesota. He has also served as Committee Chairman of Committee 7 of AREA and is also active in the Northwest Maintenance of Way Club. I would like to introduce Jim Gustafson.

Bridge Inspection Boom Device

By J. A. Gustafson

Bridge Engineer, Burlington Northern

Mr. President, ladies and gentlemen,

I will report on the Bridge Inspection Crane. My experience is limited to the crane that is in use on the Burlington Northern Railroad, therefore, I will limit my remarks to that crane. This is not to infer that the BN crane is the only one in existence because there are others.

Similar machines have been used by State Highway Departments and highway contractors for inspection and as a movable work platform for some years. Modifications of the highway vehicle design were required to produce a machine that is stable while working from the rail. Although outriggers are provided they act as an added safety factor and do not limit the movement while the inspections are being made, it is essential that it be mobile during an inspection.

Need for Inspection

Increased cost of labor caused management to look for better and cheaper means to accomplish thorough inspections. A careful inspection could require many man-hours to provide and move scaffolds and work platforms so that the points or surfaces on the outside of the structure could be inspected. Installation of walks and handrails in many structures has provided for safe inspection of the inside of girders. Handrails have also been placed on chords of trusses.

Spectacular bridge failures that have been front page news and lead stories on national TV news have focused our attention on bridges and their need for regular and thorough inspection. The failures have not been limited to the older turn of the century structures but have included recently constructed spans which used engineered materials and relatively new design concepts. We have been made aware of the fact that the details of design, fabrication, transportation and erection all affect the structures.

Recent research regarding fatigue has pointed to the importance of details that require a more careful inspection of joints and member intersections. The use of the inspection crane has permitted a close look at these joints, many of which have only been inspected by painters.

Inspection Crane Description

The crane is mounted on a hy-rail truck; in our case it is a Little Giant hy-rail chassis. For transportation in the folded, tied down position, it has a height of about 12′ above the highway. It has limited highway speed; therefore, it is generally moved on a flat car or on a low-boy. To date the movement using the low-boy has proved more of a clearance problem than on the rail. For short moves the low-boy is faster and independent of train schedules.

For train movement a car has been assigned to the crane so that tie-downs are in place, blocking for the wheels placed in the correct location, and a car of the correct height is available. Using the same car allows preclearance of the dimensional shipment which does exceed plate "C". There can be

a slight variation in regard to centerline of the car.

The GVW as shown weighs 44,000 pounds, 12,000 pounds on the front axle and 32,000 pounds on the rear tandem. This requires a special driver' s license in most states. It is a large truck that carries only the crane, no additional load. The wheel base, 174 inches, plus the distance to the hy-rail wheels, makes it long as well as heavy. It requires a good size crossing to place it on the rails. The picture shows the relationship to a 40-foot trailer. The hy-rail assembly has hooks that hold it in place while they are retracted. Care must be taken to see that those are released prior to and during the lifting of the truck onto the hy-rail wheels. They will bend if they fall back and hook. You need two men to place the crane on the rail.

The boom is supported about eight feet above the truck bed. The first section or power boom is non-telescoping type with a sixteen foot horizontal reach, hinged to the masthead. It rotates hydraulically 360 degrees and tilts 66 degrees above to 26 degrees below horizontal. It is welded box construction of high strength steel.

The second section or elevator boom hydraulically telescopes from sixteen feet to twenty-eight feet, extending downward. It is hydraulically controlled through 105 degrees rotation and is knee-action mounted to fold in parallel to the power boom. A full length aluminum access ladder, interlocking-channel type, is fastened to supports welded to both sections of the elevator boom. The ladder extends with the boom to its full twenty-eight foot length.

Inspection Crane Operation

To operate the crane, the power boom is raised to about 45 degrees, and the elevator boom is unfolded to form a 90 degree plus angle. The work platform is then folded down to make an angle of 90 degrees or more with the elevator boom, depending on the depth and width of girder that is to be inspected.

The work platform is also hydraulically operated. It is twenty-four inches wide by thirteen feet six inches long. The platform is an open type steel walkway grating reinforced and bottom trussed. The platform has individual section guard rails forty-two inches high, with mid-rail and toe boards.

The platform is capable of extending back under the bridge up to twenty-seven feet with the boom angled and can safely support a load of 600 lbs. at the extreme end. The platform is knee-action hinged to the elevator boom and hydraulically operated to fold parallel to the elevator-boom for transporting.

The crane can be operated from a platform on the bed or from a similar control panel on the work platform. There is a speaker talkback system with three stations: the cab, truck control panel, and the work platform. Both the work platform panel and the truck bed panel have stop buttons that will override the truck driver and stop all movements.

After the platform has been maneuvered into position under the structure to be inspected, using the control at truck bed level the inspector uses the access ladder to go to the platform. A safety belt is worn by the inspector with a clip that fastens onto a cable along the ladder until he reaches the platform, where he changes the clip to rings on the platform.

Using the work platform controls the platform can be maneuvered under the span or along the flanges between piers. The longitudinal movement is provided by the truck driver on instruction from the man on the platform.

If the truck movement is such that it will strike any object the inspector hits the stop button which stops everything until he can explain to the driver where the problem is.

When inspecting bridges with large piers the inspector can step onto the pier while the platform is maneuvered around him using the truck bed controls.

The outriggers are set at a few inches above the guard rail timber for safety when moving along the track. They are hydraulically operated so that they can be set to any elevation.

I do not have pictures of the inspection of a truss but such inspections are made. It does take time to get between the diagonals and the posts, but it is much faster than hanging

scaffolds. We have inspected trusses, deck plate girders, tower spans, and box girders.

We have one inspection crane which is moved between the various Regions. Movement is on a very tight schedule so that each bridge section must look at as many structures as they can in a given period of time. Certain structures are inspected every year, while others will be inspected at two or three year intervals.

If there are any questions I will be glad to attempt to answer them.

Member: Jim, you said you had to derail the override button. If the boom is actually underneath the bridge and coming up to a pier and you tell him (the operator) you only want to go ten feet and he keeps on going, does that override button actually stop it?

Mr. Gustafson: Right. The truck goes dead. Everything stops.

Member: What is the cost?

Mr. Gustafson: $140,000, Darrel says. It was manufactured by Paxton Mitchell in Omaha.

Member: It is on a Little Giant chassis.

Mr. Gustafson: Yes, this one is placed on a Little Giant truck crane chassis, but the ones that they were working on after this, I think, were placed on a different type of chassis, and you can have them built to just about any specification that you would like.

Mr. Ted Johnson: This sounds like a commercial, but there are other manufacturers as you have mentioned. One of them is Correct Manufacturing who make a similar unit except that it has three arms instead of two on the platform, and the advantage of that is that the operators can step into the platform or basket of your choice on the ground, on the bridge, so to speak, and then position themselves under the bridge, and the final arm will then rotate so they get a broader vision of the bridge. In addition, this particular Correct Manufacturing unit has the feature of being able to go directly up when you are inspecting old water towers, or buildings, or things like this, or up over a roof to do roof work, and in that configuration it has a 60-foot height.

There are a couple of other manufacturers. There is one in Italy we are looking at. It is even more versatile. There is one caution about all of these machines and that is the stability factor, people overloading the end platform. That is probably the major factor you have got to watch. As you say, you don't have much outrigger ability when you are on a bridge.

Mr. Gustafson: Yes. Thank you. As he stated, there are cranes that would let you mount the basket and then work yourself down there. To keep the stability when that arm is out and tilted out the farthest, you see you have no one in there, it is not a safety factor for any inspector. Once you get down under the bridge your center of gravity is back towards the centerline of track, and you can safely go down there and work off the platform.

Any other questions?

Member: Yes, I have one on the outrigger. Are there rollers on the bottom of them?

Mr. Gustafson: No, they are just slides maybe an inch or inch and a half or two inches, in our case where we have timber guard timbers, right above the guard timber and walk-way, so they don't touch. The only time they would come into play is should it become unstable and try to tip over, but you let it move about an inch.

Member: You use the outriggers going out and down?

Mr. Gustafson: We don't really even use the outriggers then. I guess maybe the outriggers have had use in some cases where the operators have overridden the hydraulic limit switches, but in all the cases where I have used it they have just been an added safety factor that is sitting there.

Member: You only have one outrigger?

Mr. Gustafson: No, on both sides.

Member: One on each side?

Mr. Gustafson: Yes.

Member: Will they clear double track 12-foot 9-inches or 13-foot centers?

Mr. Gustafson: You are always clear when operating. I have never operated on double track. Walt, do you try to get in from the one side, or do you have to go in from both sides?

Member: You let it project out the other side of the machine.

Member: No, I mean does it foul the second track?

Mr. Gustafson: No.

Member: Are there any speed constrictions on the highway?

Mr. Gustafson: I had something written in my notes to the effect that it is not very fast, and so when transporting it we use either the rail or we have transported it with a lowboy. We have had more problems clearance-wise when using it on lowboys really than we have on the rail, but for any distance it is not moved over the highway. You can move it to the job, but I know on our region we haven't moved it very far.

N. D. Bryant: One region ran it on the highway from Kansas City to Birmingham and back to Springfield rather than putting it on the rails.

Mr. Gustafson: Thank you, Darrel. Other regions have run it farther than we have. On our region we have used a lowboy so that we can keep the speed up to 55 miles an hour. It only travels about 35, and then it doesn't even get up to that when you are going up a hill.

Any other questions? Thank you. (Applause)

President Denz: Thank you, Mr. Davidson and Mr. Gustafson, for this fine presentation. I now turn the rostrum over to President Hernandez.

President Hernandez: Thank you, President Denz. At this time I would like to call upon our Conference Chairman, Mike Marlow, to introduce our next speaker.

Mr. Marlow: Thank you, Mr. Hernandez.

As I announced at the afternoon session of the Roadmasters, we did have a change in program. We will not be seeing the Russian movie, unfortunately. Here to introduce the program we are going to show this morning, I am going to call on Mr. Frank Richter from *Progressive Railroading.*

Mr. Richter: Thank you, Mike. I am mighty disappointed over the inability to get the Russian movie. I happened to see it last September, a year ago, just one week before the REMSA show in New Orleans at the International Railway Congress in Malaga, Spain, and I should have grabbed it right then and there and brought it along. This is an indication that while it is possible to have fairly prompt correspondence with the railroad people in Russia and in Czechoslovakia and Poland, when it comes to getting some larger piece of freight like even a reel of film it takes a long, long time. The film was sent about four weeks ago as far as I could tell from Moscow to the Russian Embassy, and then something happened in Korea you know, and it got very strained and tight. The last word I got last week was that the film probably is in Montreal waiting for some consignments that have been delayed, so maybe we will be able to see it at some other meeting. It is a very good movie, and it has English titles. It does show what the railroads of Russia do with respect to their maintenance of way practices, and it includes work on structures as well. It is really a fine one for you fellows to see. It is a disappointment that it wasn't shown.

I would like to give you a few words so that you can, in your mind's eye, see some of the things that are rather striking about the movie. The Russian railroads really are thirteen separate railroads that operate just like our large Class I railroads do. Overriding that is a very large monolithic headquarters organization in Moscow that not only takes care of the overall railroad planning and work but they do the training, they do the research work, and they do the development work. What they do then gets out on the thirteen different railroads.

A large part of Russia is North country that has to cope with the kind of severe weather that Karl Sutherland doesn't think anything of at all but has given him a lot of gray hairs. Consequently you can see that they do give a lot of attention to drainage. Much of their track is comparable to U.S. type of rail and Canadian type of rail, I think, principally because as soon as you get into Russia across the Polish border the distances are so much greater than they are separating the towns in Western Europe. Consequently they do have long stretches of track and a lot of wooden ties. They do say they have concrete ties, but it is predominantly wood. They use panel track, and their ballast is a very heavy ballast section. The movie itself shows a unique tamping machine that they use when they reballast a substantial part of the track. It is a vibratory unit that is like a plow that sets into each shoulder, down into the shoulder, and it moves right down the track vibrating. You don't have the lift, move, drop, tamp, lift, move, drop. It goes right along. You would

call it a monster. It is an electrically operated unit with, in effect, a diesel-electric locomotive with all electric motors rather than hydraulics on it.

For the regular tamping work, their surfacing work, they use the vibratory squeeze tamper just like the type that is in the Western World.

Another interesting aspect of their maintenance practices as shown in the movie is that they cascade ties as well as the rail. They pull up the rail in panels, the ties are removed at a plant, and go to a separate plant, every tie is inspected. Those that can be reused go through a regular assembly line-production plant where they dowel for split ties, they re-adze the ties, they re-treat the ties, and then those ties are reused in secondary track just like we use our used rail in secondary track.

Well, without having that movie to show, with the help of the French National Railways, we have got two reels of that very great railroad that they have built to run a high speed rail line, the TGV. One of the misconceptions about that service, principally because of its success as a high speed passenger operation with the people in France, particularly in the South of France, linking them much more closely to their capital in Paris, one of the things that is overlooked about the success of the train is how much care the French National Railways exercised in building that railroad to take the high speed trains. It is solely for passenger operation. The line is new from the outskirts of Paris right down to Lyon and Avignon in France. Some seven years ago there was a great internal struggle going on in the railroad, principally by the engineering department and the planning people, as to whether they should go ahead and build the new line. Those who held that a railroad of that sort should be more comparable to an interstate highway system, in that they had to contend with curvature as a problem rather than grades and curvature, won out. I think it is worthwhile to give you this preliminary explanation, because it was the background of the construction of the new railroad, and it was deemed essential in order to be able to not only get the track up to standards for the very, very high speeds but also to be able to maintain it that way economically. So I trust that those of you who have already seen this movie or one like it will just appreciate having the opportunity of seeing it once more, and we will still try to get that Russian movie over here.

. . . Film shown on French National Railways TGV . . .

Mr. Marlow: Thank you. Mr. Hernandez, that concludes the Roadmasters' special features for this conference.

President Hernandez: Thank you very much, Mr. Marlow. At this time I will turn the rostrum back over to President Denz.

President Denz: Now for the final feature I will call upon Mr. Davidson to be Moderator for the Panel Discussion on Guardrails on Bridges. Mr. Davidson.

PANEL DISCUSSION

Guardrails on Bridges

Moderator Davidson: I wonder if we could have the four speakers come up here to the head table.

Our next subject relates to the use of inner guard rails on bridges. Now this was probably brought about because there has been a lot of discussion over the years both from the roadmasters' standpoint and the bridge and building supervisors' standpoint of different ideas about whether or not the guardrail is necessary. There have even been rumors, completely unsubstantiated, I am sure, that some roadmasters have even removed guardrails in order to tamp track and have forgotten to put them back down. I am sure that has never happened, really.

We are going to have essentially two people talk on this subject from the standpoint of the B & B Supervisor and two others from the standpoint of the people who are responsible for maintaining the track.

We have W. S. Stokley, Roadway Engineer of the ICG; T. J. Demopoulos, Assistant Superintendent of Maintenance, Burlington Northern; J. R. Iwinski, Assistant Chief Engineer Structures, C & NW; and G. K. Clem, Manager of Engineering, Chicago, South Shore and South Bend.

We will first hear from Bill Stokley, who will tell us essentially what a guardrail is and how it looks from the B & B standpoint. Go ahead.

Mr. Stokley: Thank you, Mr. Jim. We will start our discussion this morning here with a definition of what a guardrail is. You can look in your AREA reference, and they will tell you it is something that fits alongside a frog. We in the B & B Department aren't too worried about what fits alongside a frog. So I went to Webster's Dictionary, the Unabridged, just to see what he had to say. It turns out his "A" definition of guardrail, one word, fits quite nicely. It relates to railroads, specifically "a rail placed on the inside of a main rail on bridges, at switches, et cetera, as a guard against derailment."

It sounds very good. I think we can concur with Brother Webster there, except today I think we will deal with bridges only.

One question in your mind as you sit out there might be why would this be a topic for a joint session of the Roadmasters and B & B? Everyone knows that Iwinski and Stokley are bridge folks, and Demopoulos and Clem are the track people. The answer of course is that often the bridge man likes to run his guardrail off the end of the bridge into the realm of the track man. This intrusion—I haven't got a better word for it—of the B & B function into the Roadmaster's area of course creates another opportunity for cooperation. After all, in the vast majority of the cases, the top and the southeast corner of both the bridge man's and the roadmaster's paycheck read the same. Also, the intrusion is generally limited in length and is of no particular concern except during surfacing operations.

Let's get down to some specifics and some features of what a guardrail is.

On an open deck bridge you generally find two guardrails. The outside guardrail or timber guard as it might be referred to is generally of timbers attached to the end of the ties of the tie deck, and of course is limited to the length of the open deck bridge construction. This construction serves two purposes, the primary being to retain the space of the ties in the event of the passage of a derailed wheel. It prevents the ties from sliding along the stringers, gathering, and the wheel falling through the deck and the resultant disaster. The second function of the outside timber guard is its tendency to guide a derailed wheel on the tie deck.

On a ballasted deck bridge you don't find an outside guard timber. The ballast serves

the function of keeping the ties spaced. Well, that is enough on outside guard timbers.

The guardrail is defined, you remember, as a rail placed inside the main running rail. That is not necessarily true. Some roads use structural angles, others use another timber as the inside guard.

Where would one install a guardrail? Webster says it was a guard against derailment. Should you not then install guardrails over the entire length of the property? After all, a derailment is an expensive and counterproductive event. The answer to this thesis of course is that the guardrail is expensive to install and maintain.

Webster said it was a guard, not an assurance, against derailment. The term "assurance" brings to mind the term "insurance." If you can't assure a result, maybe you would like to purchase an insurance policy against an event. If you look at a guardrail on a bridge as an insurance policy you can begin a reasoning process.

Insurance is expensive and is warranted as a protection against heavy losses only. The destruction of a major bridge would result in a heavy loss, or the long term interruption of a major traffic route would also result in a heavy loss. Therefore any major structure or any structure which would require a considerable length of time to restore would warrant an insurance policy. An insurance policy is a guardrail.

From company to company the definition of the term "major structure" and "considerable length of time" would vary. As an example, one company might consider any through span over 150 feet long a major structure. They might say that any bridge over 40 feet in height would take a long time to replace. Any structure that exceeds either of these parameters would then warrant a guardrail.

If the guardrail is an insurance policy one can reason that to a large extent the return is proportional to the investment. This translates to quality guardrail design and construction workmanship. It is thought that designs using poor second hand or good quality scrap rail, angle bars, and tie plates with new fasteners would be acceptable materials. The design should call for full bolting of joints and two spikes per tie plate.

Now so far the roadmaster is still wondering "Why am I here." We don't seem to have gone much past the bulkheads of the bridge. Well, we have to an extent in that we have a number of ballasted deck bridges, of course, that would exceed the criterion of over 40 foot high, some even more than the 150 foot span. The real question is, of course, how far is the bridge man going to run his guardrail out in the track.

Bridge ends, particularly open deck bridge ends, are always difficult to surface into and away from. Any additional construction like a guardrail only complicates the matter. We can do a little rational mathematics here. If we say that the length of a closure of a guardrail should be speed-related, then we can apply some Newtonian physics in the terms of S equals one-half AT squared. That is, the distance is one-half the acceleration times the time squared.

For starters we chose an acceleration of one-half G, 16.2 feet per second per second. With a little sketching we determined that the distance the wheel would have to move, assuming it was on the centerline of the track, to the field side of the guardrail to be about 1 foot in 8 inches. The time then comes out to be 45/100ths of a second.

A little more mathematics points out that at 10 miles per hour the closure length is 7 feet. On a 50 mile an hour operation the closure length is 35 feet. On a 90 mile an hour operation the closure length is 63 feet.

In addition we sort of put a half a rail length from the bulkhead to the beginning of closure running parallel to help align the wheel and strengthen the system, so the total length of a guardrail off the end of a bridge for a 50 mile an hour operation would be something like 44 feet 6 inches, say 45 feet.

Mr. Davidson, I will turn the podium back to you and we can begin.

Moderator Davidson: That sums up the part of the definition of what a guardrail is. Now we will hear from Tom Demopoulos, who will attack it from the roadmaster's position.

Mr. Demopoulos: I am going to tell this little story on myself. When I was a young

roadmaster we had a derailment on a through plate girder bridge which resulted in some damage to the gussets or knee braces. For some reason, there were no B & B people around that Saturday night. (Laughter) In fact, there was only myself. I found a B & B man who had been a foreman, but he had been demoted because of a bent elbowing problem. I went down to one of the local bars, and I found him, and I said "We're going to fly to Poplar, Montana because we've got a derailment on a bridge."

They flew us down there in a light plane, and my B & B man got sick. We had all kinds of problems that night, but we landed at Poplar, Montana. At the time, incidentally, Poplar ran through Reservation land belonging to the original Americans, and they were having some uprisings at the time. They were shooting at our trains and shooting at our CTC bungalows, and that was my main concern. I wasn't too worried about that bridge; I could care less. But anyway, we did go down there, and we did make as much of an inspection as I could make with the knowledge I had. But this B & B man by that time had somewhat recovered, and we got the car rerailed with the section forces, and I decided I would run trains.

Well, there was an open station only about a quarter of a mile away, and the operator came out and said "You've got to talk to St. Paul, Minnesota."

So I talked to St. Paul, Minnesota, and I talked to the man who was bridge engineer at the time, and I gave him a rundown of what damage there was. He said, "Well now, Tommy, I don't want you to run any trains on that bridge."

And I said, "Jesus, I just ran two of them."

I talked on the radio to our superintendent, and he said "There's five more coming right away, and we want to run them too."

And I said, "That's fine, boss, we'll run them."

So here I am, caught between two fires. What am I going to do?

We do have a standard plan on the Burlington Northern, and it is quite clear what is expected about guardrails on bridges. Our standard plan reads, I am going to go through this rather quickly:

"Inner guardrails shall be installed on main and siding tracks on new construction and reconstruction as follows: all through bridges, all bridges over 200 feet long or 25 feet high where allowable speed exceeds 20 MPH; all bridges having at least one span over 50 feet long on tracks with 2 degree or greater curvature where allowable speed exceeds 20 MPH; all bridges over 70 feet long where curvature exceeds 2 degrees and allowable speed exceeds 20 MPH; all tunnels with timber lining, exposed steel arch ribs, or other lining that is vulnerable to being dislodged; all structural plate type structures through which trains operate; beneath all overhead bridges where running rail is less than 10 feet from the overhead bridge support where allowable train speed exceeds 10 MPH only one guardrail is required, where the condition is limited to one side; also on ballasted deck bridges having two or more tracks only one guardrail for each outside track need be placed."

In the area I came from—I don't know if you people heard me the other day—we do an awful lot of surface correction. We have to because of the tonnage that we have. And our surfacing gangs, production surfacing gangs, only have a foreman and the operators for the machines and one truck driver. We don't have laborers there to take these guardrails off so our tamping machines can get up there and tamp up to the bridge; however, we do put the sections out there. The sections have to remove the guardrail, and once the tamping is done the guardrail has to be put back.

We look at it this way because we have gone through the derailment bit, and it is much easier to lay panels of track than it is to rebuild a bridge because of a derailment. We protect our bridges.

I had one roadmaster out there who hadn't put the guardrail back and I said, "Rex, when are you going to get this guardrail in?"

"We're going to raise it again."

O.K. I come back two weeks later, "Rex, when are you going to put the guardrail back?"

"We're going to raise it again."

I said, "Rex, all the times you have raised off the end of this bridge, the bridge has got to have been about ten foot low."

So it is something that has to be policed, that's all it is. Guardrails are important. There is no question about it. Again, it is easier on a derailment to lay panels of track than it is to rebuild a bridge. Thank you.

Moderator Davidson: Thanks, Tom. I think that is a very interesting presentation from the experience standpoint.

Next we will hear from Jerry Iwinski of the North Western who will go into this matter a little further from the B & B standpoint.

Mr. Iwinski: I guess guardrails really do serve a purpose, whether we like it or not. They are a necessary evil, and they do help in preventing derailments. I might suggest some recommended reading. In the 1974 Proceedings of the B & B there is a very, very good article on a presentation made by one of the B & B members on guardrails on bridges. It is very, very good reading. I've read it a number of times—mainly because I wrote the darn thing. (Laughter)

Well, just to go back to that presentation from 1974, we canvassed a number of railroads and we got some really good responses. Twelve of them, I guess it was out of fifteen railroads, responded and there was only one of those twelve that specifically did not put guardrails on bridges. The other ones did, but in various types and applications.

The usual application was an old scrap or piece of rail that was no longer usable for road service, and these were placed on the bridge decks, open and ballasted, in the manner described by the previous two people. The details varied considerably. Some used tie plates, some didn't use tie plates, some did not spike every tie. The guardrail is set below the top of the adjacent running rail but not lower than 2 inches below the running rail. If you have 136 pound rail you don't want another 136 pound rail next to it.

The points were another variance. A lot of roads use scrap frog points. Now that we are in such a bind we are using all our scrap frog points, and they are no longer available as they were. So we get into the process of bending rail and cutting and torching and hemstitching it together to make a usable point.

One thing we have run into is in the location of the inner guardrail. With the heavier rail and the larger tie plates you have got to watch your spacing. You have got to move out a little farther, otherwise you are going to foul your new ties plates.

There is the question of criteria, when to use guardrail. Bill and Tom had some good points, and I think the dollar replacement criterion is a good point. Again the lengths would vary depending upon the road. What is a major structure? I think we go with the individual span that is 75 feet long, or a bridge made up of multiple spans of some sort or another. When they exceed 150 feet we put on a guardrail; also on high bridges. Again it is how you feel about it. Maybe 25 feet is too low, maybe it is too high. Again it is an individual type selection.

This matter of maintenance of course is where the B & B and the track forces get together. I guess it varies from road to road as to who installs and who maintains the inner guardrail. It is kind of a gray area, but there are certain things that probably could be done or could be studied to ease the problem. Perhaps you could panelize guardrails in 39-foot sections with some kind of a strut across the bottom at certain intervals, and end the guardrail at the edge of the bridge, at the bulkhead, and have your fully bolted joint there. Then have your extension onto your embankment, into your track, again panelized so that you could take it up, put it on the side, and put it back without having to dismantle it piecemeal. I think there are a number of ways that things like this could be done, but it needs cooperation between the roadmasters and the B & B people and their respective crews.

To be effective, the entire guardrail system has to be in place. That includes the points and the rail across the bridge. You can't take one rail out, say, on a single track through span and expect it to be effective.

That is about all I have to say for it. Again I stress the idea that there should be cooperation between the two crews in trying to keep these things intact.

Moderator Davidson: Thank you, Mr. Iwinski. It was very interesting.

Next, as cleanup hitter for the Roadmasters we will introduce George Clem.

Mr. Clem: I think Jerry hit on a very good point there, cooperation, and I wish they

would cooperate with us! (Laughter) They tell us to put that guardrail out there and tell us how to put it out there, just the way they want it. Then we have got to go out twice a year and tamp up the bridge approaches every spring, every fall. Sure enough, every spring we tamp that bridge approach, and what do they want to do? They want to come out and raise the bridge, and so we have to pull that guardrail up one more time. And then they decide, after they got that bridge raised, maybe it is just a little bit out of cross level, so they want to play with it a little more. By the time we have tamped that thing three or four times we have a bunch of spike-killed ties, and I'll tell you that is just not fun to work with. Then if we try to do something else with that tie and spike it a little differently, they don't like the way we have done it, and come out and tell us to do it over.

One reason we have a lot of problems with bridge approaches is they don't get their drainage right. If they don't drain that ballasted deck bridge it frost heaves every winter and we have to go out there and do something. Then when we do that we have to come back in the spring and take the damn shims out to get it back down where it belonged in the first place.

Now another thing is those timber backwalls they love to put on trestle bridges. They don't put any drainage behind the backwalls which are forever sinking. I wish they would get those things tied back where they would stay in place.

Bill Stokley says that guardrails prevent derailments. I have never seen a guardrail yet prevent a derailment. I think they might help reduce the damage, but I don't think they prevent derailments.

He says they want to go out a short distance off a bridge. Well, if there happens to be a curve in front of that bridge, like 1,200 or 1,500 feet, they want the guardrail all the way down to the tangent portion of the track, which is quite a bit of distance to pull up.

I do a little work with the Signal Department, and of course the B & B would like to see tie plates under those guardrails, so they get a little better bearing and hold better to the bridge. Of course that shorts out your track signals, so that is always a problem. And then if we torch cut they don't like that either.

I think one of the best things you can do in track is get your joints square, so you can get them out in a hurry, and try to keep them spiked up. Maybe we can go to something like a Pandrel fastener or something so we can get the rail out of the way without spike-killing the tie. If we can get the bridge people to fix the drainage on the bridges I think we will be all set. (Applause)

President Denz: Thank you, Mr. Davidson, and thank you, the Panel.

Member: Hey, wait a minute. (Laughter) If the track department didn't overload the bridge with ballast in the first place we wouldn't have to worry about drainage.

President Denz: It looks like we have a little discussion here. How about it? Are there any questions you would like to ask?

Member: I would like to know the arguments over fully spiking and partially spiking, how they feel about it. I have a problem on my property getting them fully spiked. I have seen where fully spiking will keep the wheels in line and won't start gathering up the ties, where as with partial spiking the guardrail starts to bow in, and the wheels start to pick the ties. What is the consensus?

President Denz: Can one of you gentlemen answer that?

Mr. Stokley: Well, the most important point that you made there was gathering of ties. Your design, your bridge deck design, is going to have to take into consideration your timber guard, your outside guard on open deck structures. Ballast on ballasted deck structure should keep the ties spaced. The additional spiking of the guardrail would in fact add to the strength, the resistance to sliding of ties across the deck and that's important. If the guardrail is to do its job it seems that you would want to put as much strength into the system as you could, and additional spiking would help the rail remain upright in a situation of a wheel running against it.

Mr. Day: Might I say something, Omer?

President Denz: Yes, Mr. Day.

Fred Day (Conrail): I came in a little late so I don't know whether you discussed

whether you need guardrails or not. Did you?

President Denz: You did come in late!

Mr. Day: We don't have any guardrails except on trusses.

Member: I ran 4,100 miles of railroad with no guardrails, 4,500 miles of railroad with guardrails, and I never changed the standard on the two properties. I slept just as well riding over the one as I did over the other. I never saw a derailment that was either aided or abated by the existence or nonexistence of a guardrail. Every time the subject came up for discussion the systems people were saying, "We have got to put the damn guardrails on bridges," and I would say "Great. Let's do it. I need twelve million dollars."

President Denz: Maybe there is somebody here who wants to debate him a little bit. Anybody on our Panel, or in the audience?

Karl Sutherland (CP Rail): I might offer a suggestion after all has been said here, that the ties are always swinging at the end of bridge approaches and have to be tamped up several times during the year. Several years ago in Canada on the CN and CP we moved those guardrails in so you can tamp right up to the bridge wall. Also we have adopted the standard now of 9-foot hardwood ties for 25 ties away from there with tie pads to help that problem. That is a suggestion.

President Denz: Good suggestion.

Mr. Stokley: Let me tell you about Rockport Draw at Rockport, Kentucky, a bascule draw span. Guardrails were installed, and as a matter of fact the guardrails caused a hell of a derailment. One wheel was running far enough (in) that it picked the center of the guardrail, turned the car over, and a couple or three others; all of them went off the bridge. I don't know what it cost to replace that draw span, but twelve million dollars might go a long ways toward it. I don't think it would quite do it.

President Denz: Do we have any further questions or remarks? If not, I thank Mr. Davidson and the Panel. (Applause)

I now turn the rostrum over to President Hernandez.

President Hernandez: Before we introduce our next speaker I would like to recognize the gentleman that has been devoting all his time to the extent that he has not been able to attend many of our conferences to keep our ladies happy. I would like to introduce to you the man who has been in charge of the ladies' activities for 1983 and who has done a tremendous job for us just by keeping them happy and out of the way. Mr. Ray Snyder. (Applause)

Mr. Snyder: Also Don Lewis. Can you all hear me? I think you will find the girls had a good time. Don and I kept the girls happy and we don't ever have to worry about being asked to do it again, because they probably spent enough yesterday afternoon. (Laughter)

Lady: I'm not done yet. (Laughter)

President Hernandez: And since we have developed so much harmony between the associations, also our thanks to Don Lewis for an excellent job for the ladies. (Applause)

At this time I would like to call upon Mr. Jerry Wood to make the Resolution Report.

Report of Resolutions Committee

Having reached the closing of the annual joint conference of the Roadmasters and Maintenance of Way Association of America and the American Railway Bridge and Building Association and being deeply indebted to all those members and friends who have contributed their time and efforts to make our conference a success, it is right that we should acknowledge this indebtedness and that it shall be so entered into the minutes of this meeting.

Therefore, be it resolved that the heartfelt thanks be extended to Father Dennis Hickey of Old St. Mary's Church, who at the opening of our conference, invoked upon our deliberations the favor and guidance of Almighty God.

Be it further resolved, that our deep appreciation be extended to those who have honored our association with their presence by their informative addresses:

L. T. Cerny, AREA Executive Director
R. D. Krebs, President, Southern Pacific Transportation Company
P. C. White, Vice President Marketing, Milwaukee Road
Morton Marcus, Research Economist, Indiana University
Professor J. G. Rose, University of Kentucky
H. Vaughn, Vice President, Climbing Hoe of America
H. V. Meek, General Roadmaster, Denver & Rio Grande Western Railway
N. Woodhead, Vice President, Harben Pump
J. Gustafson, Bridge Engineer, Burlington Northern
E. Bond, Sr. Engineer Structures, Norfolk & Western
D. W. Brookings, Bridge Engineer, Kansas City Southern
T. J. Collins, President, Collins Engineers
M. C. Walbrun, Mgr. Engrg. Design, Amtrak
J. W. Bushmeyer, Area Manager, Owens-Corning Corporation
Portland Cement Association
A. C. Newberry, District Engineer, ATSF

and to all committee chairmen who, with the loyal cooperation of the committee members, prepared interesting and instructive reports that have been presented.

Be it further resolved, that a very special thanks is expressed to Mr. J. H. Bush, President of REMSA and to all members of the Railway Engineering Maintenance Suppliers Association for the fine banquet and entertainment that we enjoyed on Tuesday evening. Our thanks is also expressed to Mrs. Ray Hernandez and Mrs. Omer Denz and their committee for their efforts in arranging registration and entertainment for our wives. Also, to the management and staff of the Hyatt Regency for their cooperation and warm hospitality. We also thank the area railroads who lent assistance to our registration desk during the conference. A special thanks goes to Pat Weissmann and Joyce Grier. Without their unselfish assistance, this Association would have great difficulty functioning.

And be it finally resolved that both associations express their thanks to our outgoing presidents, Mr. Ray Hernandez of the Roadmasters, and Mr. Omer Denz of the B&B, who have spent so much time and effort in guiding the activities of our associations with great efficiency and dedication during the past year.

I move these resolutions be adopted.

Respectfully submitted,
J. G. Wood, Chairman
Resolutions Committee

President Hernandez: Thank you Mr. Wood. May we have a motion for approval?

From the floor: So moved.

President Hernandez: We have a motion. Who will second the motion?

From the floor: Second.

President Hernandez: It has been moved and seconded that the Resolutions Report be accepted as read. All in favor say aye. (Affirmative response) Opposed? (No response) The motion is carried and will be so recorded.

President Hernandez: Thank you, Mr. Wood.

For our next order of business I would like to call on our Past President, Mr. Karl Sutherland, who will install the new incoming members of the Roadmasters Association. Karl.

Joint Installation of Officers

Past President Sutherland: Thank you, President Hernandez.

I would like to ask the new Officers and Directors to come up to the front here, please.

Before beginning with the Installation of the Officers and Directors I would like to say a few words about our Association. We are celebrating our 100th Year this year, our Centennial, and during that time the membership has been maintained and indeed has increased, also our financial standing has improved and is sound today. During this Centennial Year we have for the first time an American-Mexican President. Over the years, the 100 years, we have had American Presidents and Canadian Presidents, and I think this is a real personal achievement for Ray Hernandez, and I would like to have a big hand for Ray. (Applause)

For Directors I call on John Swiderski to come up here and join me, please. John served a term for one year filling in a vacancy last year, and we are most pleased to have John return for another full term. Congratulations, John.

Next I would like to call on a new Director, Mike McGinley. Mike has been a Chairman of Standing Subject No. 2 and has done an excellent job. Congratulations, Mike.

Our next new Director is Jerry Cossell of Conrail. Would you please come forward, Jerry. Congratulations, Jerry, and welcome aboard.

Our next gentleman for Treasurer is Max Mitchell. Max has served a full term as Director, he has also served as our Treasurer for the past three years, and we are most pleased to have him for another year. Congratulations.

Our next gentleman, C. W. Moorman, Wick as we call him, has served as a Director. Last year I should say he was my Program Director when we were in New Orleans, and he did an excellent job, so we are very pleased to have you, Wick. Keep on progressing. Congratulations.

Our next gentleman is Dave Staplin. Dave has served a full term as a Director, and he has been chairman of various committees. He was also our Second Vice President and has now moved up to the high office of First Vice President. Keep on going, Dave. Congratulations.

And now for the leader of the pack, this gentleman here I have known for several years, and I guess everybody knows, from the presentation he made yesterday, that he is a born leader. He sure got that job done in a hurry. I would like to call him now, Huburt Meek. Huburt has served as a Director for a full term, Second Vice President, First Vice President, and now today he has become President and holds the top post in the Roadmasters' Association. Congratulations, Huburt.

Ladies and gentlemen, the new Board. (Applause)

At this time I would like to say thanks, Ray, and return it to you.

President Hernandez: Thank you very much, Karl, and my congratulations to the new Board. I wish them the best and I know that they will continue the high ideals of the Association.

We mentioned something about our new President, Mr. Huburt Meek, and I want you to understand he has been with the Denver & Rio Grande for 45 years, and he is

the only Charter Member that we have on the Roadmasters. He was here in 1883. (Laughter)

What I would like to do at this time is to present the President's Pin to Mr. Huburt Meek. Congratulations, Huburt. Best of luck. (Applause)

President-elect Meek: Ray, this is a great honor to have you present this pin. I had the honor of having my Chief Engineer, with whom I worked both in the Operating Department and the Maintenance of Way Department for a good number of years, present my 45 Year Pin just before he retired, and it is an honor to have you present this one. Thank you, Ray.

President Hernandez: At this time I would like to call upon Mr. Joe Bush, President of REMSA.

Mr. Bush: Thank you very much, Ray.

Mr. Meek, ladies and guests, it is a distinct pleasure for me as President of REMSA to congratulate your Association on its selection of new Officers and members. I would certainly be remiss if I did not thank Ray, all members of the Board, Pat Weissmann and Joyce Grier for the excellent cooperation REMSA has received in the past year. We know this spirit of cooperation will continue.

As most of you know, at this time REMSA presents the incoming President of Roadmasters with a Gavel symbolic of his authority during the upcoming term of office. Huburt, we know you will use this wisely, firmly, and if I know you, loquaciously, and I know you will be as good a President as your predecessor—big shoes to fill.

I am going to wait on the B & B. They are not ready yet. He just whispered that to me. Some of this harmony that Ray referred to earlier may be useful here. Unfortunately I got in late and didn't witness that report. If it happens to say Budzileni on your gavel I am sure that you will use some of this harmony and find somebody with whom to switch the gavels.

President-elect Meek: I just checked it out.

I want to thank you, Mr. Bush, and all members of your fine organization who have given the Roadmasters and the B & B such great support at our conferences.

Ladies and gentlemen, it is really nice to see such a nice turnout for the final day, because everybody is worn out and getting ready to leave and get out of Chicago, including the people who live here.

It is really a great honor for me to be elected President of the Roadmasters' Association, and I would like to thank you fellow members for your confidence in me to carry out the duties of President for the coming year. I do have a big pair of shoes to follow, in fact a couple of pairs, Karl Sutherland the year before last and Ray this last year. They are great leaders.

I would like to take this opportunity to introduce my lovely wife Virginia in the back of the room. Would you stand up please, Virginia. (Applause)

I am fortunate to have such a good group of Directors because I have worked with the majority of them, and there is only one of the new members that I haven't been acquainted with. I know that they will assist me in fulfilling my duties during the next year, and of course, with such excellent Past Presidents, I know I can call on them if I need any help.

It now gives me great pleasure as my first official duty to present Mr. Ray Hernandez with this Appreciation Award for his services as President 1982-1983.

President Hernandez: Thank you, Huburt. (Applause)

President-elect Meek: I would now like to turn the rostrum over to Mr. Denz, and I will get my gavel so that Joe doesn't give it away.

President Denz: This, the 88th Conference of the American Railway Bridge and Building Association, like the Roadmasters Conference has been very successful, but is quickly drawing to an end while my term of office as President draws to a quicker end.

This will be my last address as President, and I want to keep it short. Even though I had some nervous moments, I enjoyed my term as President and as an Executive Officer, and now I wish very much to express my sincere appreciation to the members of our Association and Pat Weissmann and the fellow officers for their kindness, assistance and enthusiastic support, which I certainly needed. I also want to thank Ray Hernandez and the officers of the Roadmasters' Asso-

ciation for their help and cooperation. On behalf of the B & B Association I wish to extend our deep thanks and gratitude to President Joe Bush and REMSA for their very gracious hospitality.

Yesterday at our meeting I had the pleasure of awarding Appreciation Plaques to each of our outgoing Directors, Don Lewis of the ICG, John Kapp of Conrail, and Dale Anthony of the Bangor & Aroostook. I assure you these were given with my congratulations, deep gratitude, and sincere thanks which they deeply deserved for their efforts and accomplishments within our B & B Association.

Paul Saletnik of the Chicago & North Western has been reelected Treasurer, while the remaining B & B Association Officers have been elected to new, advanced executive positions of which they certainly are deserving. These include Jim Budzileni of the ICG as your new President, Jim Williams of the EJ&E, First Vice President; Don Bessey of the Milwaukee Road, Second Vice President; John Kapp of Conrail to Third Vice President; Jim Davidson of the BN; Howard Laga of the North Western, and Mr. Uppal of the Canadian National as Senior Directors; Tom Kuhn of the Missouri Pacific; Don Ladner of the North Western; and Ray Tallent of the Southern as Intermediate Directors. We also have the newly elected Junior Directors, Mr. B. T. Burns of the Santa Fe, Steel Bridge Inspector; J. J. Horney of the UP, System B & B Supervisor, and Mr. W. J. Semioli, Editor of *Railway Track & Structures.*

It is now my honor and a pleasure for me to hereby declare these officers duly elected. Will all the newly elected B & B Association Officers please stand and be recognized. (Applause)

I have come to know your new President, Jim Budzileni, quite well during my term of office in the B & B Association, and I know he will not only work hard but has the necessary qualifications.

Jim, I know you and your Officers will serve the Association well, and I want to wish you and the Association continued success. If I can be of any assistance to the Association, please do not hesitate to call on me.

I now introduce your new President, Jim Budzileni, and I call on Mr. Joe Bush, President of REMSA, who will make a presentation.

Mr. Bush: Thank you, Omer, and Huburt. You gave me a great idea. I am going to pay for this later, but I would like my wife Sheila to stand up, if you will, please. I know I am going to pay for this later. (Applause)

As I stated to those of you who were at the Presidents' Dinner Sunday, this is a hell of a way to spend a honeymoon.

It is a distinct pleasure for me on behalf of REMSA to perform a similar function. We want to thank Mr. Denz and all the members of the Board and Pat and Joyce again. The rapport and harmony that was spoken of earlier I am sure will continue to exist. It does give me great pleasure to present this gavel to Mr. Budzileni, and I know you will use it equally well. Congratulations, Jim. (Applause)

President-elect Budzileni: Members, I accept with humility the honor and trust you have bestowed upon me by naming me as your President. I pledge to you my best effort to continue the fine program developed by a long line of past leaders. I ask the continued support of our staff and members as we face the tasks before us. I will call upon the wisdom and experience of our able group of past Presidents for guidance.

As with any endeavor, a most important ingredient is participation, I am therefore calling a meeting of the Executive Committee immediately after the close of this conference to launch our next year's work.

My first official act and a most satisfying one is to recognize the hard work and long service of our Immediate Past President, Mr. Omer C. Denz. Through his efforts we have enjoyed a fine conference. Mr. Denz. (Applause)

As a memento of your tenure with us and an expression of our appreciation for your service it gives me great pleasure to present this plaque to you.

Mr. Denz: Thank you.

President-elect Budzileni: Now I would like to turn the rostrum over to Mr. Meek.

President-elect Meek: Thank you, Mr. Budzileni. I would like to take this opportunity to thank the Chairmen of the Com-

mittees and their members for a job well done, and to the Executive Committee for their usual good work which has made this conference a success.

On behalf of the Roadmasters' Association I would like to express our sincere thanks to REMSA and the suppliers for their help and hospitality and the excellent entertainment at last night's Banquet.

As soon as I conclude this I would like to have the Officers of our organization meet over by the wall for a photo session, and I think they want the B & B Officers also. As soon as we get our pictures taken, I want to go over to the other end, and we will have a short Board Meeting.

Ladies and gentlemen, this concludes the 95th Annual Conference of the Roadmasters and Maintenance of Way Association of America and the 88th Annual Conference of the American Railway Bridge and Building Association. This Conference is now adjourned.

B&B Newly elected officers

Top row, left to right: J. T. Kapp, W. J. Semioli, J. J. Horney, B. T. Burns bottom, left to right: J. M. Williams, J. Budzileni, O. C. Denz, D. A. Bessey

Past Officers

	1891–1892	1892–1893	1893–1894	1894–1895
President	O. J. Travis	H. M. Hall	J. E. Wallace	Geo. W. Andrews
1st V.-Pres.	H. M. Hall	J. E. Wallace	Geo. W. Andrews	W. A. McGonagle
2nd V.-Pres.	J. B. Mitchell	G. W. Hinman	W. A. McGonagle	L. K. Spafford
3rd V.-Pres.	James Stannard	N. W. Thompson	L. K. Spafford	James Stannard
4th V.-Pres.	G. W. Hinman	C. T. Fuller	E. D. Hines	Walter G. Berg
Secretary	C. W. Gooch	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	George M. Reid	George M. Reid	George M. Reid	George M. Reid
Executive Members	W. R. Damon	G. W. Andrews	Q. McNab	James Stannard
	G. W. Markley	J. M. Staten	A. S. Markley	James H. Travis
	W. A. McGonagle	J. M. Caldwell	Floyd Ingram	J. H. Cummin
	C. W. McGehee	Q. McNab	James Stannard	R. M. Peck
	G. W. Turner	Floyd Ingram	James H. Travis	J. L. White
	J. E. Wallace	A. S. Markley	J. H. Cummin	A. Shane

	1895–1896	1896–1897	1897–1898	1898–1899
President	W. A. McGonagle	James Stannard	Walter G. Berg	J. M. Cummin
1st V.-Pres.	L. K. Spafford	Walter G. Berg	J. H. Cummin	A. S. Markley
2nd V.-Pres.	James Stannard	J. H. Cummin	A. S. Markley	C. C. Mallard
3rd V.-Pres.	Walter G. Berg	A. S. Markley	G. W. Hinman	W. A. Rogers
4th V.-Pres.	J. H. Cummin	R. M. Peck	C. C. Mallard	J. M. Staten
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	George M. Reid	N. W. Thompson	N. W. Thompson	N. W. Thompson
Executive Members	R. M. Peck	W. O. Eggleston	G. J. Bishop	Wm. S. Danes
	L. J. White	W. M. Noon	C. P. Austin	J. H. Markley
	A. Shane	J. M. Staten	M. Riney	W. O. Eggleston
	A. S. Markley	G. J. Bishop	Wm. S. Danes	R. L. Heflin
	W. M. Noon	C. P. Austin	J. H. Markley	F. W. Tanner
	J. M. Staten	M. Riney	W. O. Eggleston	A. Zimmerman

	1899–1900	1900–1901	1901–1902	1902–1903
President	Aaron S. Markley	W. A. Rogers	W. S. Danes	B. F. Pickering
1st V.-Pres.	W. A. Rogers	W. S. Danes	B. F. Pickering	C. C. Mallard
2nd V.-Pres.	J. M. Staten	B. G. Pickering	A. Shane	A. Shane
3rd V.-Pres.	Wm. S. Danes	A. Shane	A. Zimmerman	A. Zimmerman
4th V.-Pres.	B. F. Pickering	A. Zimmerman	C. C. Mallard	A. Montzheimer
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	N. W. Thompson	N. W. Thompson	N. W. Thompson	N. W. Thompson
Executive Members	T. M. Strain	T. M. Strain	A. Montzheimer	W. E. Smith
	R. L. Heflin	H. D. Cleaveland	W. E. Smith	A. W. Merrick
	F. W. Tanner	F. W. Tanner	A. W. Merrick	C. P. Austin
	A. Zimmerman	A. Montzheimer	C. P. Austin	C. A. Lichty
	H. D. Cleaveland	W. E. Smith	C. A. Lichty	W. O. Eggleston
	A. Montzheimer	A. W. Merrick	W. O. Eggleston	J. H. Markley

	1903–1904	1904–1905	1905–1906	1906–1907
President	A. Montzheimer	C. A. Lichty	J. B. Sheldon	J. H. Markley
1st V.-Pres.	A. Shane	J. B. Sheldon	J. H. Markley	R. H. Reid
2nd V.-Pres.	C. A. Lichty	J. H. Markley	R. H. Reid	J. P. Canty
3rd V.-Pres.	J. B. Sheldon	R. H. Reid	R. C. Sattley	H. Rettinghouse
4th V.-Pres.	J. H. Markley	R. C. Sattley	J. P. Canty	F. E. Schall
Secretary	S. F. Patterson	S. F. Patterson	S. F. Patterson	S. F. Patterson
Treasurer	C. P. Austin	C. P. Austin	C. P. Austin	C. P. Austin
Executive Members	R. H. Reid	W. O. Eggleston	H. Rettinghouse	W. O. Eggleston
	W. O. Eggleston	A. E. Killam	A. E. Killam	A. E. Killam
	A. E. Killam	H. Rettinghouse	J. S. Lemond	J. S. Lemond
	R. C. Sattley	J. S. Lemond	C. W. Richey	C. W. Richey
	H. Rettinghouse	W. H. Finley	W. O. Eggleston	H. H. Eggleston
	J. S. Lemond	C. W. Richey	F. E. Schall	B. J. Sweatt

	1907–1908	1908–1909	1909–1910	1910–1911
President	R. H. Reid	J. P. Canty	H. Rettinghouse	H. Rettinghouse
1st V.-Pres.	J. P. Canty	H. Rettinghouse	J. S. Lemond	F. E. Schall
2nd V.-Pres.	H. Rettinghouse	F. E. Schall	F. E. Schall	A. E. Killam
3rd V.-Pres.	F. E. Schall	J. S. Lemond	A. E. Killam	J. N. Penwell
4th V.-Pres.	W. O. Eggleston	A. E. Killam	J. N. Penwell	L. D. Hadwen
Secretary	S. F. Patterson	S. F. Patterson	C. A. Lichty	C. A. Lichty
Treasurer	C. P. Austin	C. P. Austin	J. P. Canty	J. P. Canty
Executive Members	A. E. Killam	J. N. Penwell	W. Beahan	T. J. Fullem
	J. S. Lemond	Willard Beahan	F. B. Scheetz	G. Aldrich
	C. W. Richey	F. B. Scheetz	L. D. Hadwen	P. Swenson
	T. S. Leake	W. H. Finley	T. J. Fullem	G. W. Rear
	W. H. Finley	L. D. Hadwen	G. Aldrich	W. O. Eggleston
	J. N. Penwell	T. J. Fullem	P. Swenson	W. F. Steffens

	1911–1912	1912–1913	1913–1914	1914–1915
President	F. E. Schall	A. E. Killam	J. N. Penwell	L. D. Hadwen
1st V.-Pres.	A. E. Killam	J. N. Penwell	L. D. Hadwen	G. Aldrich
2nd V.-Pres.	J. N. Penwell	L. D. Hadwen	G. Aldrich	G. W. Rear
3rd V.-Pres.	L. D. Hadwen	T. J. Fullem	G. W. Rear	C. E. Smith
4th V.-Pres.	T. J. Fullen	G. Aldrich	C. E. Smith	E. B. Ashby
Secretary	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Treasurer	J. P. Canty	J. P. Canty	J. P. Canty	F. E. Weise
Executive Members	G. Aldrich	G. W. Rear	W. F. Steffens	W. F. Steffens
	P. Swenson	W. F. Steffens	E. B. Ashby	S. C. Tanner
	G. W. Rear	E. B. Ashby	S. C. Tanner	Lee Jutton
	W. F. Steffens	C. E. Smith	Lee Jutton	F. F. Strouse
	E. B. Ashby	S. C. Tanner	W. F. Strouse	C. R. Knowles
	W. O. Eggleston	Lee Jutton	C. R. Knowles	A. Ridgway

	1915–1916	1916–1917	1917–1918	1918–1919
President	G. W. Rear	C. E. Smith	S. C. Tanner	Lee Jutton
1st V.-Pres.	C. E. Smith	E. B. Ashby	Lee Jutton	F. E. Weise
2nd V.-Pres.	E. B. Ashby	S. C. Tanner	F. E. Weise	W. F. Strouse
3rd V.-Pres.	S. C. Tanner	Lee Jutton	W. F. Strouse	C. R. Knowles
4th V.-Pres.	Lee Jutton	F. E. Weise	C. R. Knowles	A. Ridgway
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Executive Members	F. E. Weise	W. F. Strouse	A. Ridgway	J. S. Robinson
	W. F. Strouse	C. R. Knowles	J. S. Robinson	J. P. Wood
	C. R. Knowles	A. Ridgway	J. P. Wood	A. B. McVay
	A. Ridgway	J. S. Robinson	D. C. Zook	J. H. Johnston
	J. S. Robinson	J. P. Wood	A. B. McVay	E. T. Howson
	J. P. Wood	D. C. Zook	J. H. Johnston	C. W. Wright

	1919–1920	1920–1921	1921–1922	1922–1923
President	F. E. Weise	W. F. Strouse	C. R. Knowles	Arthur Ridgway
1st V.-Pres.	W. F. Strouse	C. R. Knowles	A. Ridgway	J. P. Wood
2nd V.-Pres.	C. R. Knowles	A. Ridgway	J. S. Robinson	J. S. Robinson
3rd V.-Pres.	A. Ridgway	J. S. Robinson	J. P. Wood	C. W. Wright
4th V.-Pres.	J. S. Robinson	J. P. Wood	C. W. Wright	E. T. Howson
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.			F. E. Weise	F. E. Weise
Directors	J. P. Wood	C. W. Wright	E. T. Howson	F. C. Baluss
	A. B. McVay	A. B. McVay	J. H. Johnson	Maro Johnson
	J. H. Johnston	G. A. Manthey	E. K. Barrett	O. F. Dalstrom
	E. T. Howson	E. T. Howson	F. C. Baluss	S. D. Corey
	C. W. Wright	J. H. Johnston	Maro Johnson	W. B. Hotson
	G. A. Manthey	E. K. Barrett	O. F. Dalstrom	P. N. Nelson

	1923–1924	1924–1925	1925–1926	1926–1927
President	J. S. Robinson	J. P. Wood	C. W. Wright	E. T. Howson
1st V.-Pres.	J. P. Wood	C. W. Wright	E. T. Howson	F. C. Baluss
2nd V.-Pres.	C. W. Wright	E. T. Howson	F. C. Baluss	Maro Johnson
3rd V.-Pres.	E. T. Howson	F. C. Baluss	Maro Johnson	J. S. Huntoon
4th V.-Pres.	F. C. Baluss	Maro Johnson	J. S. Huntoon	C. S. Heritage
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.	F. E. Weise	F. E. Weise	F. E. Weise	F. E. Weise
Directors	S. T. Corey	J. S. Huntoon	C. S. Heritage	A. I. Gauthier
	W. B. Hotson	A. I. Gauthier	W. B. Hotson	E. L. Sinclair
	P. N. Nelson	E. L. Sinclair	P. N. Nelson	P. F. Dalstrom
	J. S. Huntoon	C. S. Heritage	A. I. Gauthier	W. T. Krausch
	A. I. Gauthier	W. B. Hotson	E. L. Sinclair	R. C. Bardwell
	E. L. Sinclair	P. N. Nelson	O. F. Dalstrom	H. I. Benjamin

	1927–1928	1928–1929	1929–1930	1930–1934
President	F. C. Baluss	Maro Johnson	J. S. Huntoon	C. S. Heritage
1st V.-Pres.	Maro Johnson	J. S. Huntoon	C. S. Heritage	A. I. Gauthier
2nd V.-Pres.	J. S. Huntoon	C. S. Heritage	A. I. Gauthier	H. I. Benjamin
3rd V.-Pres.	C. S. Heritage	A. I. Gauthier	H. I. Benjamin	W. T. Krausch
4th V.-Pres.	A. I. Gauthier	H. I. Benjamin	W. T. Krausch	T. H. Strate
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.	F. E. Weise	F. E. Weise		
Directors	W. T. Krausch	R. C. Henderson	G. A. Rodman	E. C. Neville
	R. C. Bardwell	J. S. Ekey	W. A. Batey	H. H. Best
	H. I. Benjamin	T. H. Strate	F. W. Hillman	J. E. King
	R. C. Henderson	G. A. Rodman	E. C. Neville	A. B. Scowden
	T. H. Strate	W. A. Batey	H. H. Best	W. A. Batey
	J. S. Ekey	F. W. Hillman	J. E. King	L. C. Smith

	1934–1935	1935–1936	1936–1937	1937–1938
President	H. I. Benjamin	T. H. Strate	E. C. Neville	C. M. Burpee
1st V.-Pres.	T. H. Strate	E. C. Neville	C. M. Burpee	F. H. Masters
2nd V.-Pres.	E. C. Neville	C. M. Burpee	F. H. Masters	W. S. Lacher
3rd V.-Pres.	A. B. Scowden	F. H. Masters	C. A. J. Richards	C. A. J. Richards
4th V.-Pres.	W. R. Roof	C. A. J. Richards	W. S. Lacher	F. H. Cramer
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Directors	C. M. Burpee	A. L. McCloy	W. R. Roof	B. R. Meyers
	W. A. Batey	R. P. Luck	T. P. Soule	G. S. Crites
	L. C. Smith	H. H. Best	F. H. Cramer	R. E. Dove
	C. A. J. Richards	W. R. Roof	B. R. Meyers	T. P. Soule
	A. L. McCloy	T. P. Soule	G. S. Crites	A. Chinn
	R. P. Luck	F. H. Cramer	R. E. Dove	L. G. Byrd

	1938–1939	1939–1940	1940–1941	1941–1942
President	Armstrong Chinn	A. E. Bechtelheimer	H. M. Church	R. E. Dove
1st V.-Pres.	F. H. Cramer	F. H. Cramer	R. E. Dove	F. H. Soothill
2nd V.-Pres.	A. E. Bechtelheimer	H. M. Church	F. A. Soothill	G. S. Crites
3rd V.-Pres.	H. M. Church	R. E. Dove	G. S. Crites	A. M. Knowles
4th V.-Pres.	R. E. Dove	F. H. Soothill	A. M. Knowles	N. D. Howard
Sec.-Treas.	C. A. Lichty	C. A. Lichty		
Secretary	. . . . .	. . . . .	F. O. Whiteman	A. G. Shaver
Treasurer	. . . . .	. . . . .	F. E. Weise	F. E. Weise
Directors	L. G. Byrd	B. R. Meyers	N. D. Howard	R. E. Caudle
	W. R. Ganser	W. Walkden	L. G. Byrd	I. A. Moore
	F. H. Soothill	A. S. Krefting	K. L. Miner	W. A. Sweet
	B. R. Meyers	A. M. Knowles	R. E. Caudle	J. L. Varker
	W. Walkden	L. G. Byrd	I. A. Moore	L. E. Peyser
	A. S. Krefting	K. L. Miner	W. A. Sweet	Martin Meyer

	1942–1943	1943–1944	1944–1945	1945–1946
President	G. S. Crites	J. L. Varker	J. L. Varker	N. D. Howard
1st V.-Pres.	R. E. Caudle	R. E. Caudle	R. E. Caudle	F. G. Campbell
2nd V.-Pres.	A. M. Knowles	N. D. Howard	N. D. Howard	J. S. Hancock
3rd V.-Pres.	N. D. Howard	F. G. Campbell	F. G. Campbell	E. H. Barnhart
4th V.-Pres.	J. L. Varker	J. S. Hancock	J. S. Hancock	W. F. Martens
Secretary	A. G. Shaver†	Elinor V. Heffern	Elise LaChance	Elise LaChance
	Lorene Kindred‡			
	Elinor V. Heffern			
Treasurer	F. E. Weise	C. R. Knowles	C. R. Knowles	C. R. Knowles
Treasurer Emeritus		F. E. Weise	F. E. Weise	
Directors	M. Meyer	W. F. Martens	W. F. Martens	A. B. Chapman
	L. E. Peyser	A. L. McCloy	A. L. McCloy	W. A. Huckstep
	K. L. Miner	L. C. Winkelhaus	L. C. Winkelhaus	F. R. Spofford
	F. G. Campbell	E. H. Barnhart	E. H. Barnhart	Guy E. Martin
	J. S. Hancock	A. B. Chapman	A. B. Chapman	B. R. Meyers
	L. C. Winkelhaus	L. E. Peyser	L. E. Peyser	L. E. Peyser

† To November 1, 1942 ‡ To February 1, 1943

	1946–1947	1947–1948	1948–1949	1949–1950
President	F. G. Campbell	J. S. Hancock	E. H. Barnhart	W. F. Martens
1st V.-Pres.	J. S. Hancock	E. H. Barnhart	W. F. Martens	W. A. Huckstep
2nd V.-Pres.	E. H. Barnhart	W. F. Martens	W. A. Huckstep	Guy E. Martin
3rd V.-Pres.	W. F. Martens	W. A. Huckstep	Guy E. Martin	F. R. Spofford
4th V.-Pres.	W. A. Huckstep	G. E. Martin	F. R. Spofford	Lee Mayfield
Secretary	Elise LaChance	Elise LaChance	Elise LaChance	Elise LaChance
Treasurer	C. R. Knowles	C. R. Knowles	L. C. Winkelhaus	L. C. Winkelhaus
Directors	Guy E. Martin	H. M. Harlow	Lee Mayfield	H. M. Harlow
	B. R. Meyers	H. B. Christianson	F. M. Misch	V. E. Engman
	L. E. Peyser	F. R. Spofford	W. D. Gibson	G. W. Benson
	H. M. Harlow	Lee Mayfield	H. M. Harlow	F. M. Misch
	H. B. Christianson	Franz M. Misch	V. E. Engman	L. R. Morgan
	F. R. Spofford	W. D. Gibson	G. W. Benson	J. A. Jorlett

	1950–1951	1951–1952	1952–1953	1953–1954
President	W. A. Huckstep	Guy E. Martin	F. R. Spofford	Lee Mayfield
1st V.-Pres.	Guy E. Martin	F. R. Spofford	Lee Mayfield	H. M. Harlow
2nd V.-Pres.	F. R. Spofford	Lee Mayfield	H. M. Harlow	J. A. Jorlett
3rd V.-Pres.	Lee Mayfield	H. M. Harlow	J. A. Jorlett	R. R. Gunderson
4th V.-Pres.	H. M. Harlow	J. A. Jorlett	R. R. Gunderson	W. H. Huffman
Secretary	Elise LaChance	Elise LaChance	Elise LaChance	Elise LaChance
Treasurer	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus
Directors	F. M. Misch	M. H. Dick	W. H. Huffman	M. H. Dick
	L. R. Morgan	R. R. Gunderson	L. R. Morgan	J. F. Warrenfells
	J. A. Jorlett	J. F. Warrenfells	B. M. Stephens	G. Switzer
	M. H. Dick	W. H. Huffman	M. H. Dick	B. M. Stephens
	R. R. Gunderson	L. R. Morgan	J. F. Warrenfells	W. H. Bunge
	J. F. Warrenfells	B. M. Stephens	G. Switzer	E. R. Schlaf

	1954–1955	1955–1956	1956–1957	1957–1958
President	H. M. Harlow	J. A. Jorlett	R. R. Gunderson	W. H. Huffman
1st V.-Pres.	J. A. Jorlett	R. R. Gunderson	W. H. Huffman	M. H. Dick
2nd V.-Pres.	R. R. Gunderson	W. H. Huffman	M. H. Dick	B. M. Stephens
3rd V.-Pres.	W. H. Huffman	M. H. Dick	B. M. Stephens	H. D. Curie
4th V.-Pres.	M. H. Dick	B. M. Stephens	H. D. Curie	
Secretary	Elise LaChance	Elise LaChance	Elise LaChance	Elise LaChance
Treasurer	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus
Directors	B. M. Stephens	J. F. Warrenfells	W. H. Bunge	G. W. Benson
	W. H. Bunge	H. D. Curie	E. R. Schlaf	J. M. Lowry
	E. R. Schlaf	J. M. Lowry	G. W. Benson	H. H. Matthews
	J. F. Warrenfells	W. H. Bunge	J. M. Lowry	T. M. VonSprecken
	H. D. Curie	E. R. Schlaf	T. M. VonSprecken	W. H. Bunge
	J. M. Lowry	G. W. Benson	H. A. Matthews	E. R. Schlaf

	1958–1959	1959–1960	1960–1961	1961–1962
President	M. H. Dick	B. M. Stephens	H. D. Curie	G. W. Benson
1st V.-Pres.	B. M. Stephens	H. D. Curie	G. W. Benson	J. M. Lowry
2nd V.-Pres.	H. D. Curie	G. W. Benson	J. M. Lowry	E. R. Schlaf
3rd V.-Pres.	G. W. Benson	J. M. Lowry	E. R. Schlaf	H. A. Matthews
Secretary	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg
Treasurer	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus	L. C. Winkelhaus
Directors	J. M. Lowry	W. H. Bunge	H. A. Matthews	R. C. Baker
	R. C. Baker	E. R. Schlaf	M. J. Hubbard	R. H. Miller
	W. H. Bunge	H. A. Matthews	R. C. Baker	Shirley White
	E. R. Schlaf	M. J. Hubbard	R. H. Miller	H. M. Wilson
	H. A. Matthews	R. C. Baker	Shirley White	R. D. Hellweg
	M. J. Hubbard	R. H. Miller	H. M. Wilson	F. W. Hutcheson

	1962–1963	1963–1964	1964–1965	1965–1966
President	J. M. Lowry	E. R. Schlaf	R. C. Baker	H. M. Wilson
1st V.-Pres.	E. R. Schlaf	R. C. Baker	H. M. Wilson	R. D. Hellweg
2nd V.-Pres.	H. A. Matthews	Shirley White	R. D. Hellweg	J. W. DeValle
3rd V.-Pres.	R. C. Baker	H. M. Wilson	J. W. DeValle	W. F. Armstrong
Secretary	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg
Treasurer	L. C. Winkelhaus	E. F. Snyder	E. F. Snyder	E. F. Snyder
Directors	Shirley White	R. D. Hellweg	W. F. Armstrong	J. A. Goforth
	H. M. Wilson	F. W. Hutcheson	J. S. Ellis	E. R. Simmons
	R. D. Hellweg	W. F. Armstrong	J. A. Goforth	N. D. Bryant
	F. W. Hutcheson	J. W. DeValle	E. R. Simmons	A. R. Dahlberg
	W. F. Armstrong	J. A. Goforth	N. D. Bryant	J. S. Ellis
	J. W. DeValle	E. R. Simmons	A. R. Dahlberg	T. L. Fuller

	1966–1967	1967–1968	1968–1969	1969–1970
President	R. D. Hellweg	J. W. DeValle	W. F. Armstrong	J. A. Goforth
1st V.-Pres.	J. W. DeValle	W. F. Armstrong	J. A. Goforth	A. R. Dahlberg
2nd V.-Pres.	W. F. Armstrong	J. A. Goforth	A. R. Dahlberg	T. L. Fuller
3rd V.-Pres.	J. A. Goforth	A. R. Dahlberg	T. L. Fuller	N. D. Bryant
Secretary	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg	Ruth Weggeberg
Treasurer	W. H. Huffman	W. H. Huffman	W. H. Huffman	W. H. Huffman
Directors	N. D. Bryant	J. S. Ellis	N. F. Lucas	W. H. Rankin
	A. R. Dahlberg	T. L. Fuller	W. L. Short	E. E. Runde
	H. F. Lucas	R. A. Youngblood	C. E. Wachter	T. A. Reynolds
	J. S. Ellis	H. F. Lucas	A. C. Jones	J. J. Ridgeway
	T. L. Fuller	W. L. Short	W. H. Rankin	J. R. Williams
	R. A. Youngblood	C. E. Wachter	E. E. Runde	J. W. Chambers
	V. D. Raessler	A. C. Jones	T. A. Reynolds	R. E. Frame
	W. L. Short	W. H. Rankin	J. J. Ridgeway	J. C. Hobbs
	C. E. Wachter	E. E. Runde	J. R. Williams	

	1970–1971	1971–1972	1972–1973	1973–1974
President	A. R. Dahlberg	T. L. Fuller	N. D. Bryant	E. E. Runde
1st V.-Pres.	T. L. Fuller	N. D. Bryant	E. E. Runde	J. J. Ridgeway
2nd V.-Pres.	N. D. Bryant	E. E. Runde	J. J. Ridgeway	J. R. Williams
3rd V.-Pres.	E. E. Runde	J. J. Ridgeway	J. R. Williams	W. R. Rankin
Secretary	Ann Wilson	Ann Wilson	Ann Wilson	Ann Wilson
Treasurer	W. H. Huffman	W. H. Huffman	W. H. Huffman	W. H. Huffman
Directors	T. A. Reynolds	J. W. Chambers	R. K. Corbett	D. C. Gould
	J. J. Ridgeway	R. E. Frame	J. R. Iwinski	W. S. Stokely
	J. R. Williams	J. C. Hobbs	J. S. Pritchett	W. C. Sturm
	J. W. Chambers	R. K. Corbett	D. C. Gould	J. W. Davidson
	R. E. Frame	J. R. Iwinski	W. S. Stokely	C. A. Hughes
	J. C. Hobbs	J. S. Pritchett	W. C. Sturm	W. R. Hyma
	R. K. Corbett	D. C. Gould	J. W. Davidson	O. C. Denz
	J. R. Iwinsky	W. S. Stokely	C. A. Hughes	R. C. McMaster
	J. S. Pritchett	W. C. Sturm	W. R. Hyma	W. E. Brakensiek

	1974–1975	1975–1976	1976–1977	1977–1978
President	J. J. Ridgeway	J. R. Williams	W. H. Rankin	J. R. Iwinski
1st V.-Pres.	J. R. Williams	W. H. Rankin	J. R. Iwinski	W. C. Sturm
2nd V.-Pres.	W. H. Rankin	J. C. Hobbs	W. C. Sturm	D. C. Gould
3rd V.-Pres.	J. C. Hobbs	J. R. Iwinski	D. C. Gould	J. W. Chambers
Secretary	Ann Wilson	Ann Wilson	Ann Wilson	Ann Wilson
Treasurer	W. H. Huffman	W. H. Huffman	W. H. Huffman	W. H. Huffman
Directors	J. W. Davidson	W. E. Brakensiek	J. W. Chambers	W. J. Gunkle
	C. A. Hughes	O. C. Denz	M. Noyszewski	W. E. Halley
	W. R. Hyma	R. C. McMaster	W. J. Gunkle	K. L. Wammell
	W. E. Brakensiek	F. R. Lindsay	W. E. Halley	J. Budzileni
	O. C. Denz	M. Noyszewski	K. L. Wammel	B. J. King
	R. C. McMaster	W. C. Sturm	J. Budzileni	J. G. Robertson
	F. B. Lindsay, Jr.	W. J. Gunkle	B. J. King	O. C. Denz
	M. Noyszewski	W. E. Halley	J. G. Robertson	E. C. Patterson
	Jim Payne	K. L. Wammel		W. S. Stokely

	1978–1979	1979–1980	1980–1981	1981–1982
President	W. C. Sturm	D. C. Gould	J. W. Chambers	W. R. Hyma
Sr. V.-Pres.	D. C. Gould	J. W. Chambers	R. C. McMaster	O. C. Denz
Jr. V.-Pres.	J. W. Chambers	R. C. McMaster	W. R. Hyma	J. Budzileni
Jr. V.-Pres.	R. C. McMaster	W. R. Hyma	O. C. Denz	J. M. Williams
Secretary	Ann Wilson	Ann Wilson	Ann Wilson	Pat Weissmann
Treasurer	W. F. Armstrong	W. F. Armstrong	W. F. Armstrong	W. C. Sturm
Directors	J. Budzileni	O. C. Denz	J. W. Davidson	D. A. Bessey
	B. J. King	W. J. Gunkle	C. M. Russell	J. N. Michel
	J. G. Robertson	W. S. Stokely	J. M. Williams	P. H. Saletnik
	O. C. Denz	L. D. Green	D. A. Bessey	O. D. Anthony
	E. C. Patterson	C. M. Russell	J. N. Michel	J. T. Kapp
	W. S. Stokely	J. M. Williams	P. H. Saletnik	D. J. Lewis
	L. D. Green	D. A. Bessey	O. D. Anthony	J. W. Davidson
	C. M. Russell	J. N. Michel	J. T. Kapp	H. J. Laga
	J. M. Williams	P. H. Saletnik	D. J. Lewis	A. S. Uppal

	1982–1983
President	O. C. Denz
Sr. Vice President	J. Budzileni
Jr. Vice President	J. M. Williams
Jr. Vice President	D. A. Bessey
Secretary	P. A. Weissmann
Treasurer	P. H. Saletnik
Directors	O. D. Anthony
	J. T. Kapp
	D. J. Lewis
	J. W. Davidson
	H. J. Laga
	A. S. Uppal
	T. E. Kuhn
	D. R. Ladner
	R. A. Tallent

CONSTITUTION

ARTICLE I.

NAME

Section 1. This association shall be known as the American Railway Bridge & Building Association.

ARTICLE II.

OBJECT

Section 1.** The object of this association shall be the advancement of knowledge pertaining to the design, construction and maintenance of railway bridges, buildings, water service facilities, and other structures, by investigation, reports and discussions.

Section 2. The association shall neither endorse nor recommend any particular devices, trade marks or materials, nor will it be responsible for any opinions expressed in papers, reports or discussion unless the same have received the endorsement of the association in regular session.

ARTICLE III.

MEMBERSHIP

Section 1.* The membership of this association shall be divided into four classes, viz: Members, life members, associate members and honorary members.

Section 2.* A member shall be a person in a position above rank of gang foreman in connection with engineering, construction and maintenance for railway bridges, buildings and water service facilities: or in the employ of a public regulatory body, a professor of engineering or architecture, a technical editor, a government or private timber expert, a consulting engineer, or an engineer in his employ, engaged in the engineering, construction and maintenance of railroad-related facilities or an engineer employed by a technical service or research and development organization, an officer or engineer of an engineering or scientific society or association whose aims and objectives are compatible with the aims and objectives of this association. Any person desirous of becoming a member shall make application upon the form prescribed by the executive committee, setting forth his name, age, residence and practical experience. He shall furnish at least three references to whom he is personally known. Applicants may be voted into membership at any regular executive meeting or by letter ballot of the executive committee, a majority vote being necessary in either instance.

Section 3.** To be eligible for a life membership a member must have belonged to the association for at least 15†† years and in general must have retired from active railway service due to age or physical disability. He shall have all the privileges of membership, except the holding of office, and shall not be required to pay annual dues. The transfer from membership to life membership shall be made in the same manner as the election of members, as prescribed in Section 2, of this Article.

Section 4. Associates shall be responsible persons who are not eligible as members, whose pursuits or attainments qualify them to co-operate with members in the study and development of improved practices in the construction and maintenance of bridges, buildings and water facilities. They shall have all the rights of members except of voting and holding office. They shall be elected in the manner prescribed for members, in Section 2 of this Article.

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*Amended September, 1976.
**Amended September 20, 1948
††Amended March 10, 1958.

Section 5. Honorary members shall be chosen from persons who have attained acknowledged eminence in some branch of engineering or railway service. Their number shall be limited to ten. Honorary members shall be proposed by not less than six active members and shall be elected by the unanimous vote of the members present at a regular meeting. They shall have all the rights of members except that of holding office and shall be exempt from the payment of dues.

Section 6. Any member guilty of conduct unbecoming to a railroad officer and a member of this association, or who shall refuse to comply with the rules of this association, shall forfeit his membership on a two-thirds vote of the executive committee.

Section 7. Membership shall continue until written resignation is received by the secretary, unless member has been previously expelled, or dropped for non-payment of dues in accordance with Section 1 of Article VII.

Section 8.** Only members shall hold office in this association, and only members and life members shall be entitled to vote in the election of officers.

ARTICLE IV.

OFFICERS

Section 1‡‡. The officers of the Association shall be a President, two Junior Vice Presidents, a Senior Vice President, a Treasurer and nine Directors, who, with the most recent Past President, shall constitute the Executive Committee.

Section 2. The past presidents of this association, previous to the most recent past president, who continue to be members shall be privileged to attend all meetings of the executive committee, of which meetings they shall receive due notice, and be permitted to discuss all questions and to aid said committee by their advice and counsel; but said past presidents shall not have a right to vote, unless called upon to fill a quorum.

Section 3. Vacancies in any office shall be filled for the unexpired term by the executive committee without delay.

ARTICLE V.

EXECUTIVE COMMITTEE

Section 1.** The executive committee shall manage the affairs of the association and shall have full power to control and regulate all matters not otherwise provided for in the constitution and by-laws and shall exercise general supervision over the financial interests of the association, and make all necessary purchases and contracts required to conduct the general business of the association, but shall not have the power to render the association liable for any debt beyond the amount then in the treasury plus accounts receivable and not subject to other prior liabilities. All appropriations for special purposes must be acted upon at a regular meeting of the association.

Section 2. Meetings of the executive committee may be called by a majority of the members of the committee, providing 10 days' notice is given members by mail.

Section 3. Five members of the executive committee shall constitute a quorum for the transaction of business.

ARTICLE VI.

ELECTION OF OFFICERS AND SECRETARY AND TENURE OF OFFICE

Section 1. Except as otherwise provided the officers shall be elected at the regular annual meeting of the association and the election shall not be postponed except by unanimous consent of the members present at said annual meeting. The election shall be by ballot, a majority of the votes cast being required for election. Any member of the

*Amended October 16, 1941.
†Amended September 21, 1957.
‡Amended September 28, 1966.
‡‡Amended September 20, 1978.
° Amended October 7, 1982.

association not in arrears for dues shall be eligible for office, but the president shall not be eligible for re-election.

Section 2††. The President, two Junior Vice Presidents, and Treasurer shall hold office for one year and the Directors for three years; three Directors being elected each year. The Senior Vice President shall hold office for one year and ascend to the office of President at the expiration of such service. All officers shall retain their office until their successors are elected and installed. A Director elected for a three-year term shall not be eligible to serve two consecutive terms.

Section 3.° The term of office of the treasurer may be terminated at any time by two-thirds vote of Executive Committee. The compensation of the treasurer shall be fixed by a majority vote of the Executive Committee.

Section 4.° The secretary shall be appointed by a majority vote of the Executive Committee and the term shall terminate with the appointment of successor. The Executive Committee shall have the power, by two-thirds vote, to remove the secretary and appoint successor at any time. The salary of the secretary shall be decided by a majority vote of the Executive Committee.

Section 5.° The secretary and the treasurer shall be required to give bond in an amount to be fixed by the Executive Committee.

ARTICLE VII.

MEMBERSHIP FEE AND DUES

Section 1†. Every member upon joining this association shall pay to the secretary an entrance fee and dues as prescribed by the executive committee. No member in arrears for annual dues shall be entitled to vote at any election and any member more than one year in arrears, may be stricken from the list of members at the discretion of the executive committee.

Section 2.‡ A person stricken from the list of members because of non-payment of dues, upon written application may be reinstated as a member in his former class without loss of privileges, either upon payment of all back dues (which must accompany applications) or at the discretion of the executive committee voting in the manner prescribed in Section 2, Article III.

ARTICLE VIII.*

LOCAL SECTIONS

Section 1.** Upon the application of ten or more members of the association residing in the same geographical district, or having offices therein, the executive committee shall organize a local section for that district, to which all members in that district shall be eligible. Such local section shall admit to active membership only members in good standing. It shall hold not less than two meetings each year, and shall be governed by such constitution and by-laws not inconsistent with the constitution of this association as the section membership may adopt and the executive committee approve.

Section 2. The parent association shall not be put under any obligation, either financial or in the matter of policy or opinion, by any local section.

ARTICLE IX.

AMENDMENTS

Section 1. This constitution may be amended at any regular meeting by a two-thirds vote of the members present, provided that notice of the proposed amendment or amendments has been sent to the members at least 30 days previous to said regular meeting.

By-Laws

TIME OF MEETING

1.** The regular meeting of this association shall convene annually during the month of September, the exact date to be fixed by the executive committee.

PLACE OF MEETING

2.** The place of holding the annual convention shall be Chicago, Ill.

3. It shall be within the power of the executive committee to change the location or time of the meeting if it becomes apparent that it is for the best interests of the association.

QUORUM

4. At the regular meeting of the association, 15 or more members shall constitute a quorum.

***DUES

5. The annual dues for the fiscal year ending August 31, and payable in advance, shall be as follows:°

Members, $12.00; Associate Members, $12.00.

DUTIES OF OFFICERS

6.† The president shall have general supervision over the affairs of the association. He shall preside at all meetings of the association and of the executive committee; shall appoint all committees not otherwise provided for, and shall be ex-officio member of all committees. He shall with the secretary sign all contracts or other written obligations of the association which have been approved by the executive committee. He shall render a detailed report at least three times during the year to the members of the executive committee, showing the financial condition of the association and its activities.

At the annual meeting the president shall present a report containing a statement of the general conditions of the association.

7.‡‡ The Vice-Presidents in order of seniority shall preside at meetings in the absence of the President and discharge his duties in case of a vacancy in his office. The Senior Vice President shall have the senior position of Vice Presidents.

8.† It shall be the duty of the secretary to keep a correct record of the proceedings of all meetings of this association, and of all accounts, between this association and its members; to collect all moneys due the association, and deposit the same in the name of the association. He shall pay all bills when properly certified and approved by the president and the treasurer, and make such reports as may be called for by the executive committee. He shall also perform such other duties as the association may require.

9.‡ The treasurer shall have charge of the funds, check all deposits as made by the secretary, sign all checks after they have been approved by the president, and invest all funds not needed for current expenses as directed by the executive committee. He shall report at each annual meeting on the condition of the finances.

NOMINATING COMMITTEE

10.# After each annual meeting the president shall appoint a committee consisting of five members. Two Past Presidents shall be members of this committee, one of whom shall act as Chairman. No other officers of the Association shall be appointed to this committee. This committee shall prepare a list of names of nominees for officers to be voted on at the next annual convention in accordance with ARTICLE VI of the Constitution, said list to be read at the business session of said convention. Nothing in this section shall be construed to prevent any member making further nominations provided that such nominations are received by the President in writing not less than thirty (30) days in advance of the first day of the annual meeting. Such nominations should be addressed to the President of the Association at its headquarters office.

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‡Adopted October 17, 1940.
#Amended March 23, 1983.
†Amended September 20, 1948.
‡Amended September 21, 1957.
‡‡Amended September 20, 1978.

AUDITING COMMITTEE

11.‡ Prior to each annual meeting the president shall appoint a committee of three members, not officers of the association, whose duty it shall be to examine the accounts and vouchers of the secretary and the treasurer and certify as to the correctness of their accounts.

COMMITTEE ON SUBJECTS FOR DISCUSSION

12. After each annual meeting the president shall appoint a committee whose duty it shall be to prepare a list of subjects for investigation to be submitted for approval at the next convention.

COMMITTEE ON INVESTIGATION

13. After the association has adopted the list of subjects for investigation the president for the succeeding year shall appoint the committees who shall prepare the subjects for report and discussion. He may also appoint individual members to prepare reports on special subjects, or to report on any special or particular subject.

PUBLICATION COMMITTEE

14. After each annual meeting the executive committee shall appoint a publication committee consisting of three active members whose duty it shall be to cooperate with the secretary in the issuing of the publications of the association. The assignment of this committee shall be such that at least one member shall have served on the committee during the previous year.

ORDERS OF BUSINESS

15.† Call to order by president.
Opening prayer or invocation.
President's address.
Report of secretary.
Report of treasurer.
Appointment of special committees.
Reports of standing committees and presentation of papers.
Unfinished business.
New business.
Election of officers.
Installation of officers.
Adjournment.

DECISIONS

16. The votes of a majority of the members present shall decide any questions, motion or resolution which shall be brought before the association, unless otherwise provided. Unless specifically provided herein otherwise, all discussions shall be governed by Robert's rules of order.

AMENDMENTS

17.† The By-Laws can be amended by a two-thirds vote of those present at any regularly called executive committee meeting.

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†Amended September 20, 1948.
*Article adopted 1922.
**Amended September 20, 1948.
‡Amended September 21, 1957.
***Amended September 15, 1965.
° Amended April 1, 1982.

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ALPHABETICAL LIST OF ALL MEMBERS

M Indicates Member
A Indicates Associate Member
L Indicates Life Member
H Indicates Honorary Member

(Figures following name indicate year in which membership became effective)

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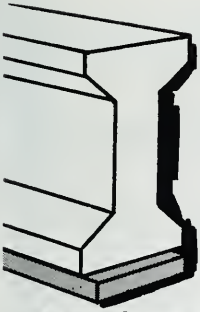
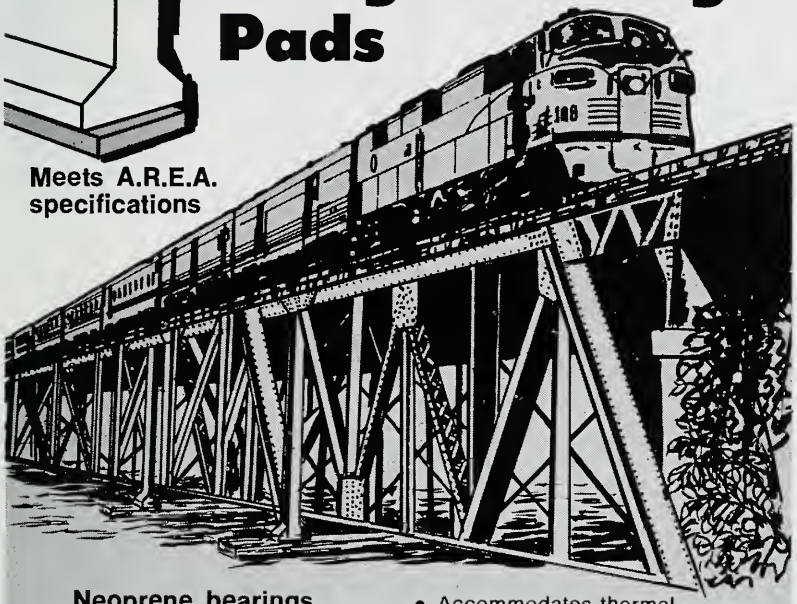


Neoprene Bridge Bearing Pads

Meets A.R.E.A. specifications



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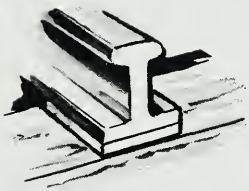
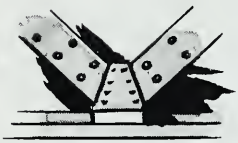
Bridges



Railroads



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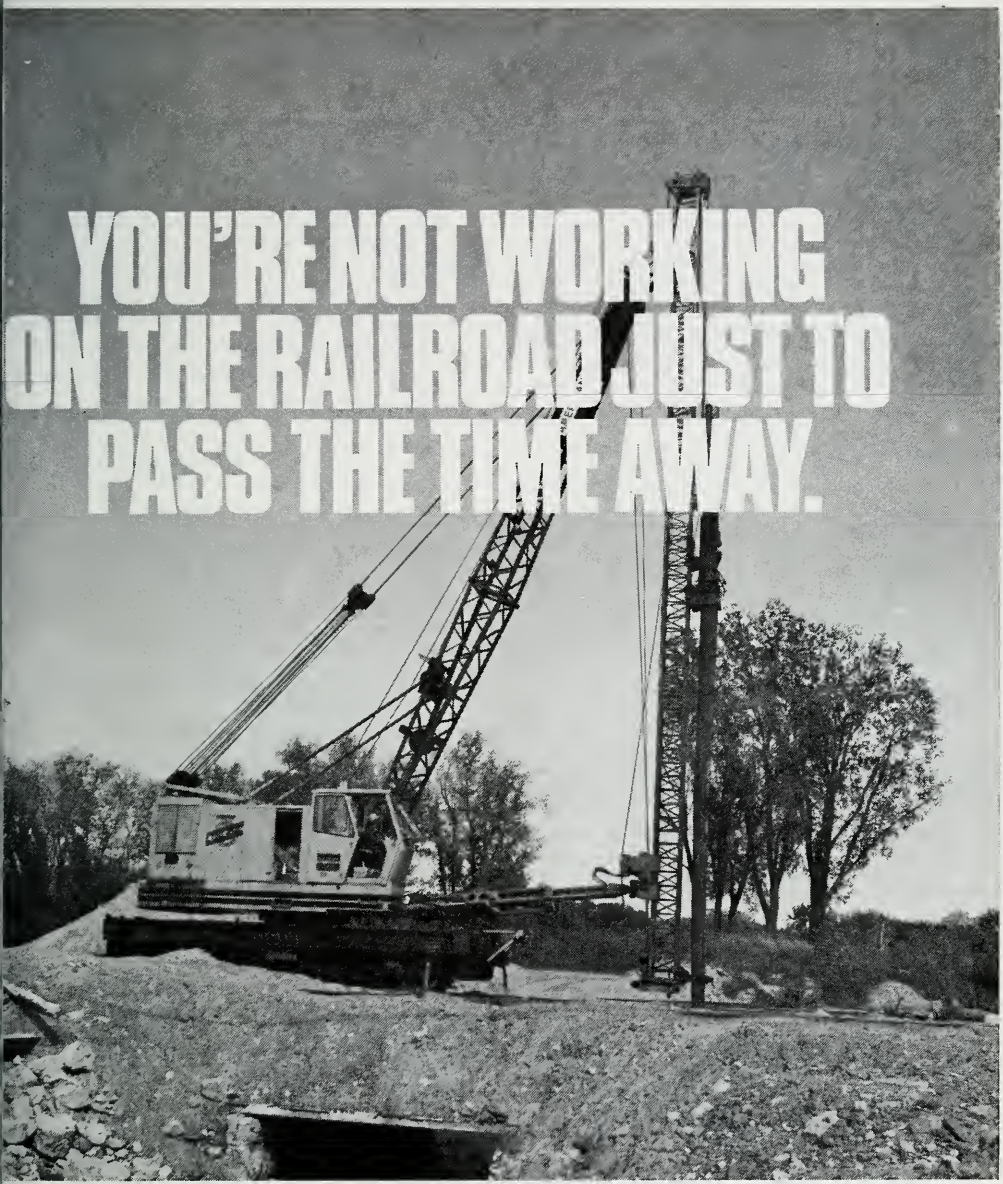

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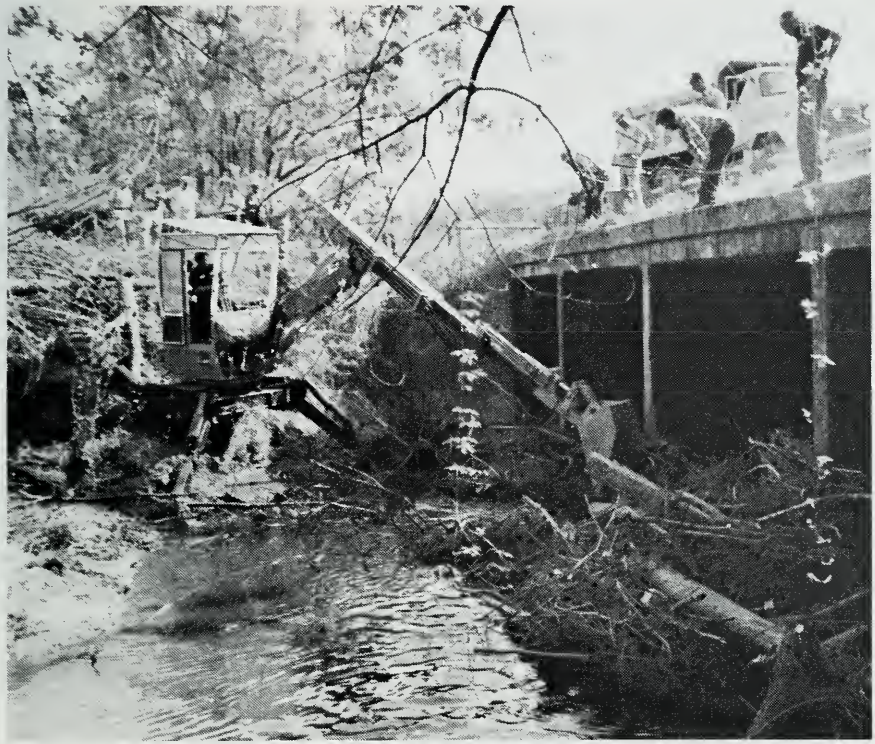

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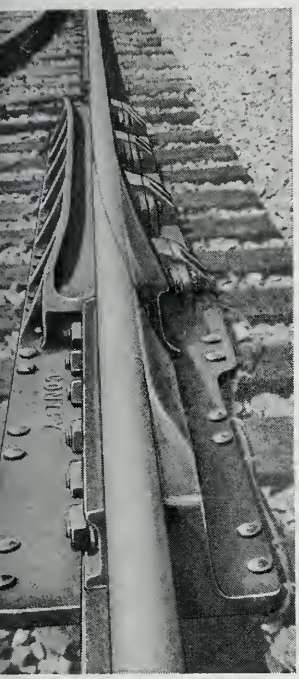

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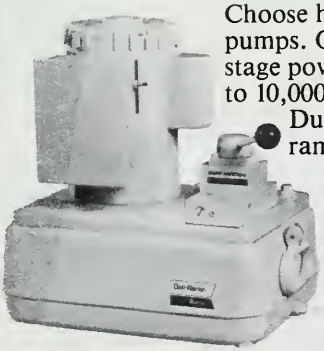

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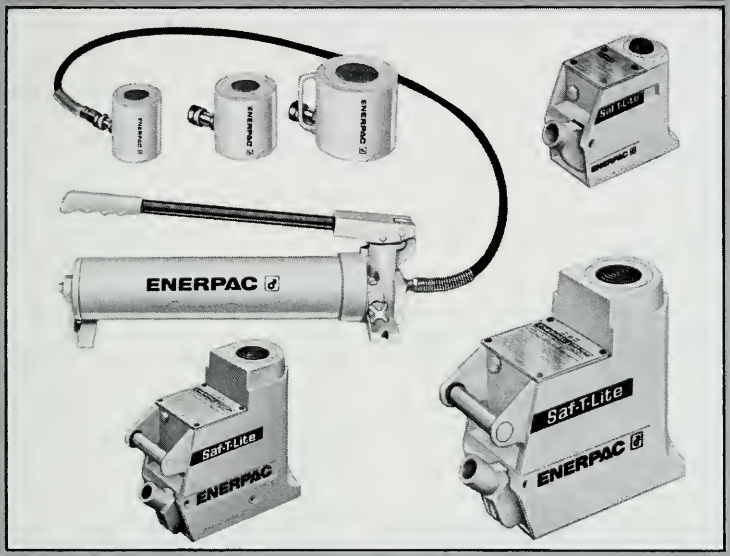

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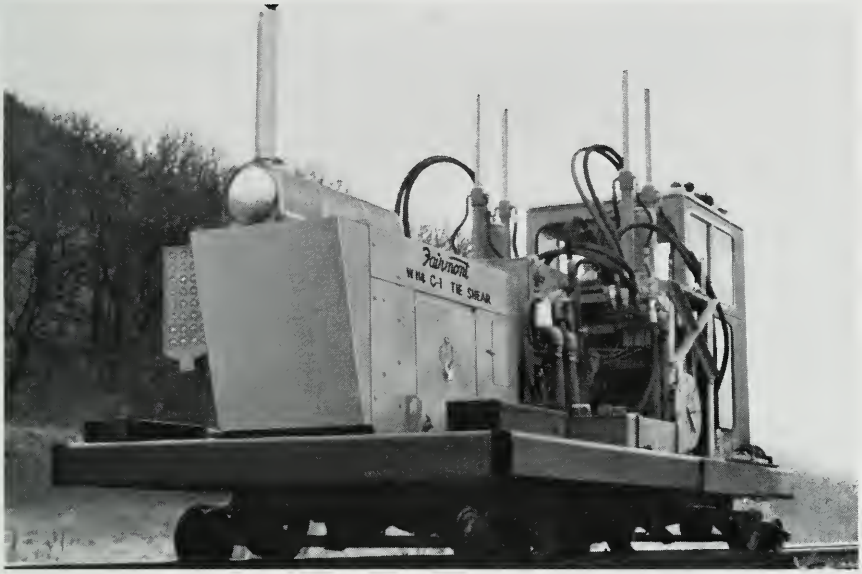

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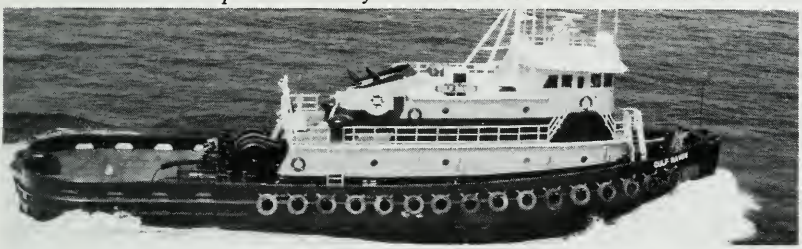

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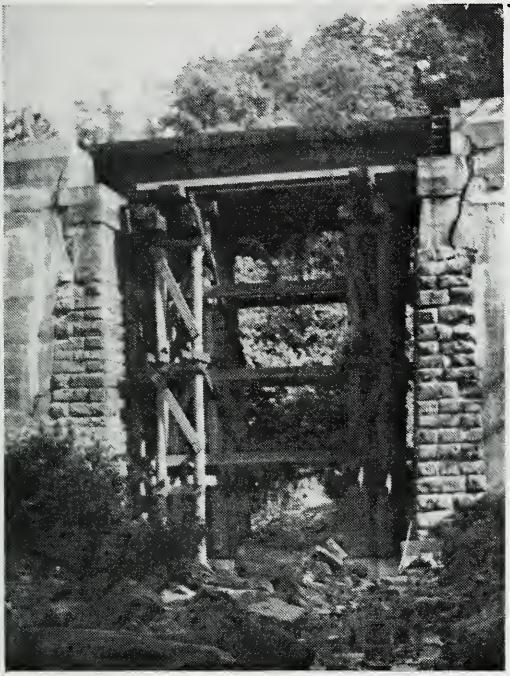

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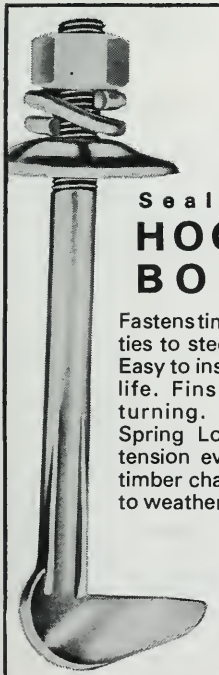

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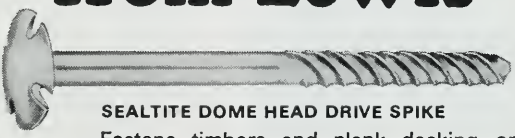

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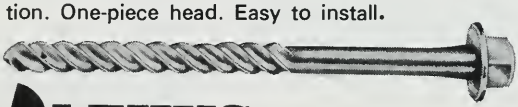

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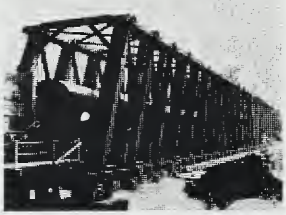

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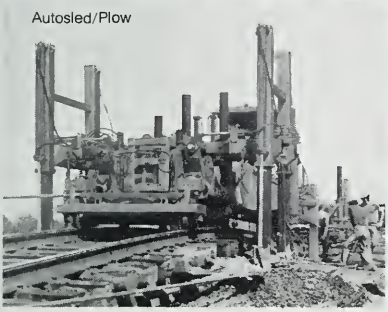
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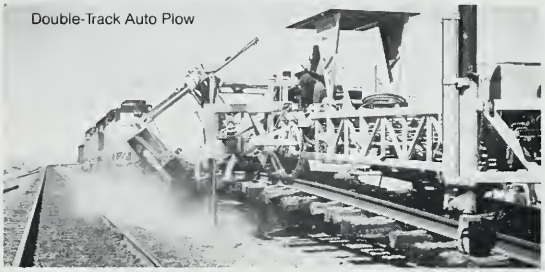
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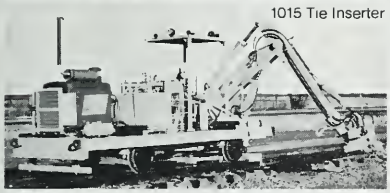
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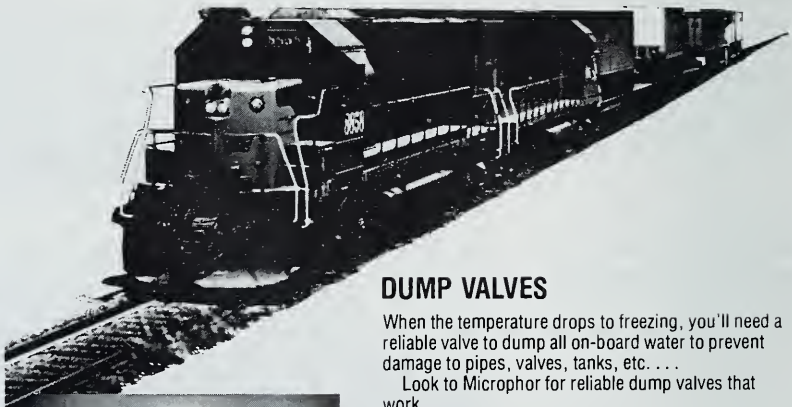

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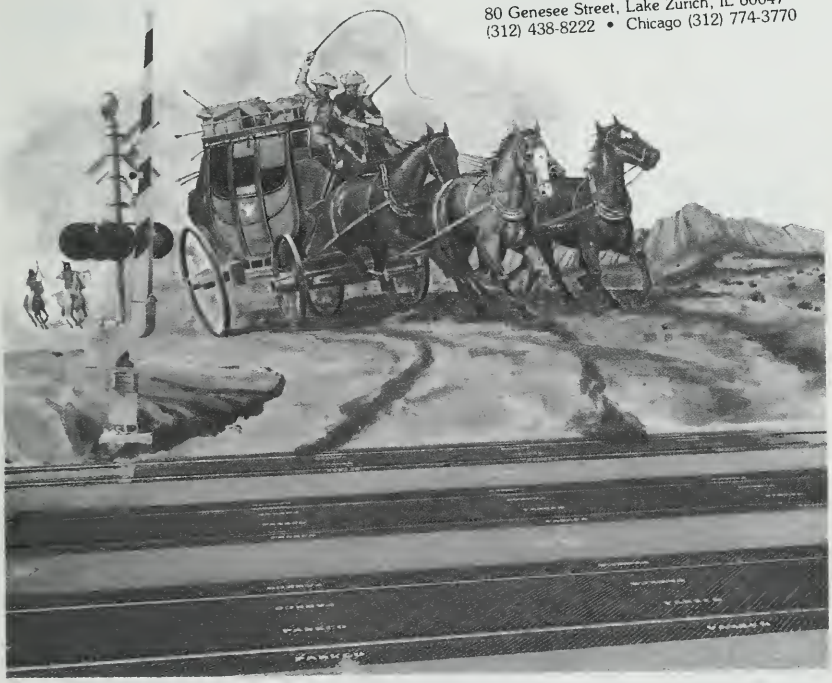

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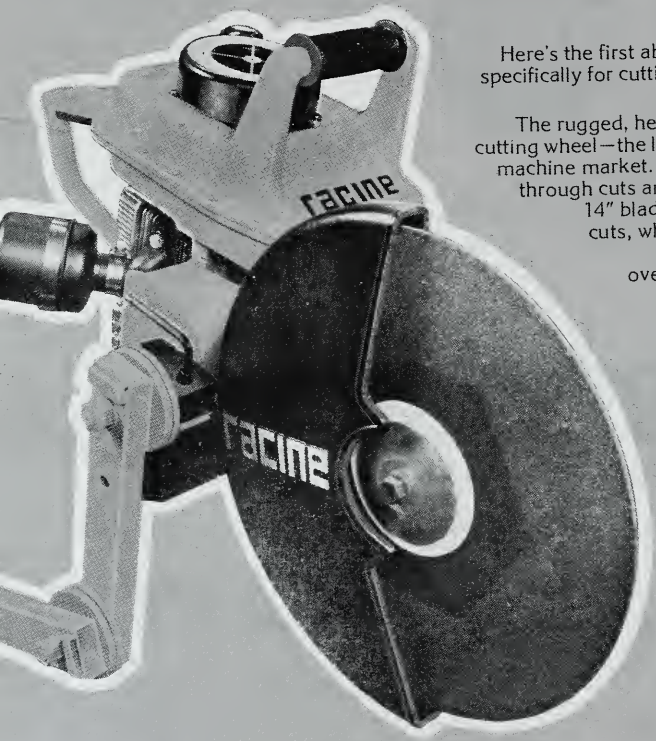

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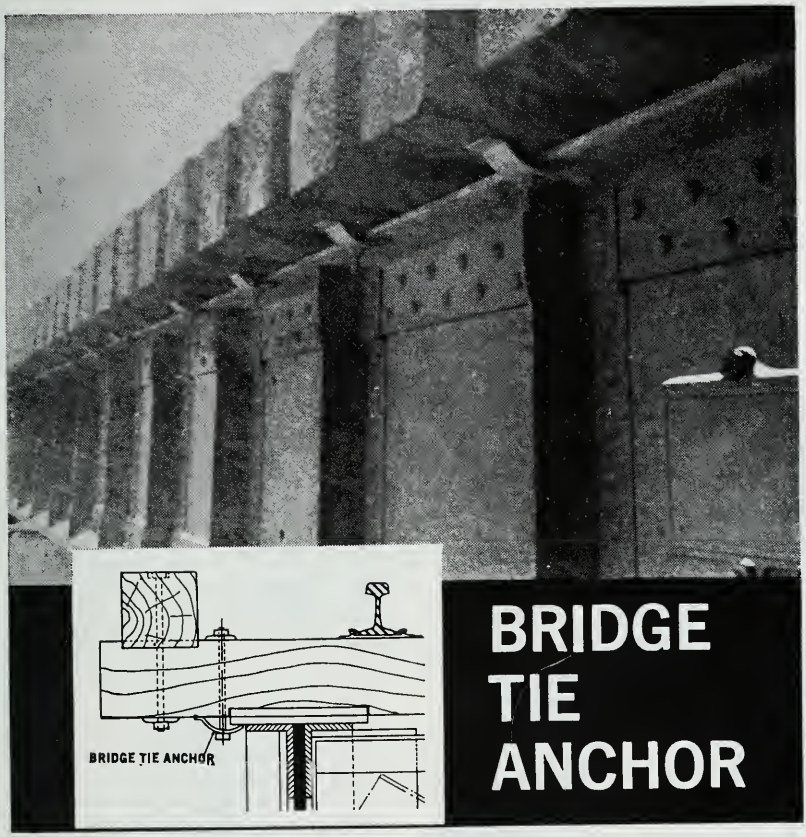

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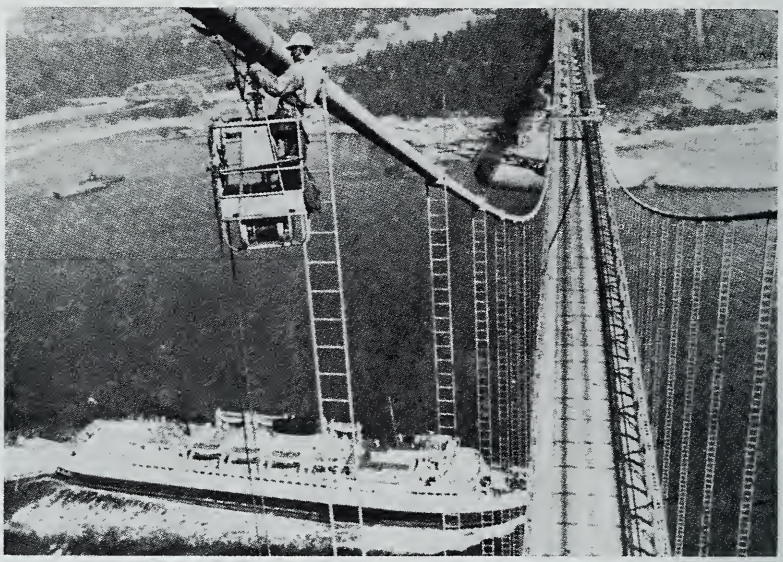
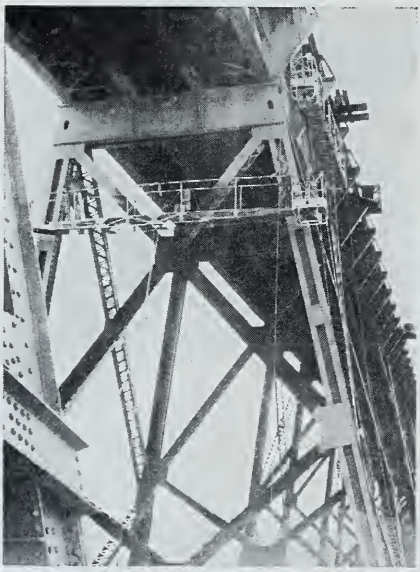


RIDING HIGH—Painter operates his Spider horizontally and vertically along cable of Lions Gate Bridge, Vancouver, B. C.



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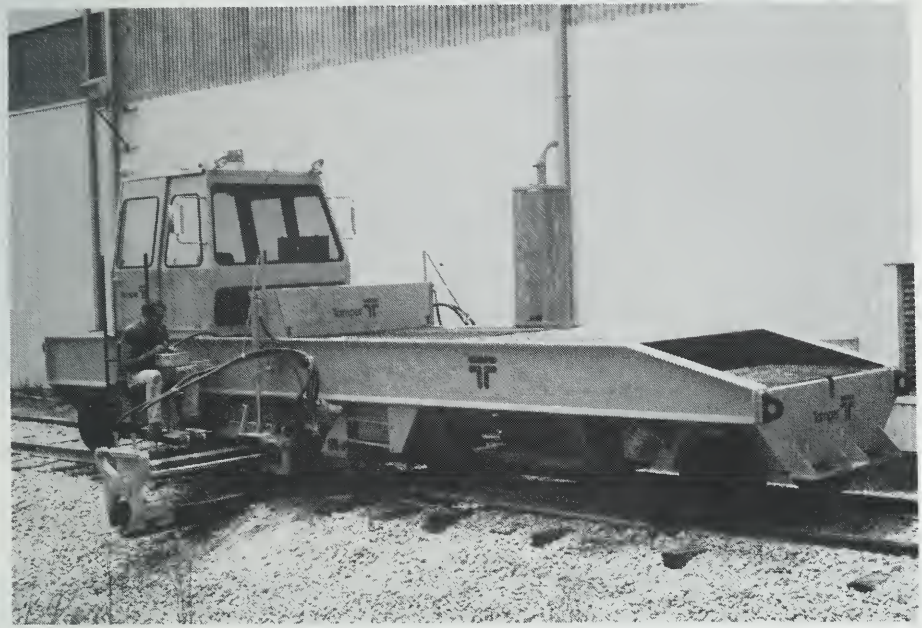

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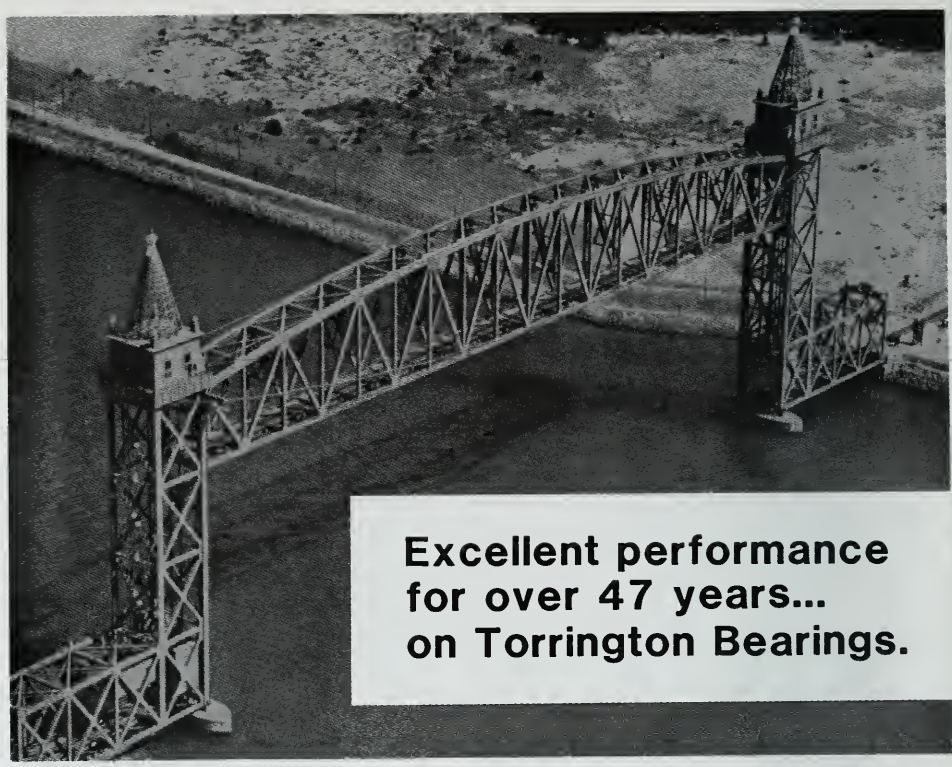

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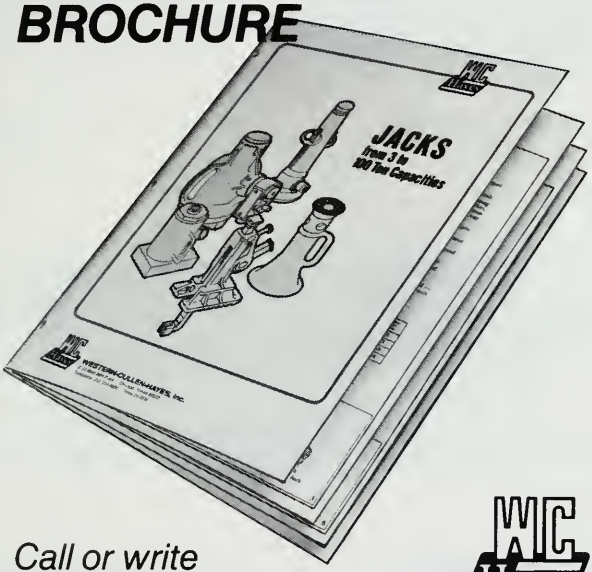

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BIBLIOGRAPHY OF CONTENTS

of Proceedings of

the

American Railway

BRIDGE & BUILDING

Association

1974–1983

VOLUME 79 (1974)

Committee Reports:

Inner and Outer Guard Rails on Bridges (J. R. Iwinski/J. C. Hobbs, Co-Chmn.)
Protection of Bridges Over Navigable Streams (M. Noyszewski, Chmn.)
Concrete Restoration (B. J. King, Chmn.)

VOLUME 80 (1975)

Committee Reports:

Trends Toward Bridges Built with Combination Timber, Concrete and Steel Components (J. G. Robertson, Chmn.)
Fire Protection Systems for Bridges and Buildings (W. E. Halley, Chmn.)
Controlling Water Pollution at Mechanical Facilities (W. J. Gunkle, Chmn.)
Selection and Maintenance Mechanical Facilities for Buildings (W. C. Sturm, O. C. Denz, F. D. Day, E. B. Dobranetski and J. L. Gray)

VOLUME 81 (1976)

Committee Reports:

History of Railroad Bridge Development (James Budzileni, Chmn.)
Planning and Scheduling B&B Work (R. C. Force, Chmn.)
Problems Encountered In Remodeling Existing Buildings (W. C. Sturm, Chmn.)

VOLUME 82 (1977)

Committee Reports:

Replacing or Making Heavy Repairs to Bridges Having Continuous Welded Rail (W. W. Haines, Chmn.)
Effect of Unit Train Operation on Bridges (F. D. Day, Chmn.)
Maintenance of Branch Line Bridges (E. C. Patterson, Chmn.)

VOLUME 83 (1978)

Committee Reports:

Organization of Steel Bridge Gangs (B. T. Burns, Chmn.)
Criteria for Selection of Metal Versus Masonry Buildings (D. A. Bessey, Chmn.)
Waterproofing Railroad Bridges (J. M. Williams, Chmn.)
Steel Stringer Bridge Construction and Installing Under Traffic (C. M. Russell, Chmn.)

VOLUME 84 (1979)

Committee Reports:

Track Scales (W. J. Gunkle, Chmn.)
Clearance of Oversized Loads (J. C. Calhoun, Chmn.)
Methods for Reducing Energy Consumption in Existing Buildings (presented by Paul H. Saletnik)

VOLUME 85 (1980)

Committee Reports:

Bridge Inspection (D. R. Ladner, Chmn.)
Maintenance of Moveable Bridges (D. J. Lewis, Chmn.)
Selection of Interior & Exterior Material for Buildings (J. T. Kapp, Chmn.)

VOLUME 86 (1981)

Committee Reports:

Evaluation and Repair of Fire Damaged Steel Bridges (A. S. Uppal, Chmn.)
Renewing Caps on Ballast Deck Bridges (R. A. Tallent, Jr., Chmn.)
Prevention of Roofing Failures (K. N. Kerns, Chmn.)
Locomotive Fueling Spill Prevention and Spill Collection System (Howard Laga, Chmn.)

VOLUME 87 (1982)

Committee Reports:

Movement of Locomotive Cranes, (T. E. Kuhn, Chmn.)
Culvert Maintenance and Replacement, (D. R. Ladner, Chmn.)
Maintenance & Replacement of Bridge Bearings, (S. Lipkus, Chmn.)

VOLUME 88 (1983)

Committee Reports

Slide Control and Prevention (J. E. Johnson, Chairman)
Replacement of Through Trusses (J. G. Bradley, Chairman)
Environmental Compliance and How It Affects B&B (W. P. Cunningham, Chairman)
Recycling Old Buildings (J. A. Campbell, Chairman)